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VIEWS, NEWS AND INTERVIEWS.

This story comes out of the West and concerns the haughty Mrs. Brown, of Chicago. One morning recently she proceeded from the breakfast table to the telephone in the hall closet to order things from her market man.

"Hello"! said Mrs. Brown, "is this the Oakland Market? Yes? Well, this is Mrs. Brown's residence. Will you please send me a large, thick, juicy steak by four o'clock"?

The boy employed in the Oakland Market happened to answer the telephone, and promptly responded:

"Well, you just bet your sweet life I will!"

"Do you know, sir, to whom you are speaking?" indignantly inquired Mrs. Brown.

"Sure I do", said the boy. "You're Jenny, Mrs. Brown's cook."

"You are mistaken, young man. You are speaking with Mrs. Brown herself."

"Is that so"? replied the boy. "Then in that case, madame, we'll call the bet off."

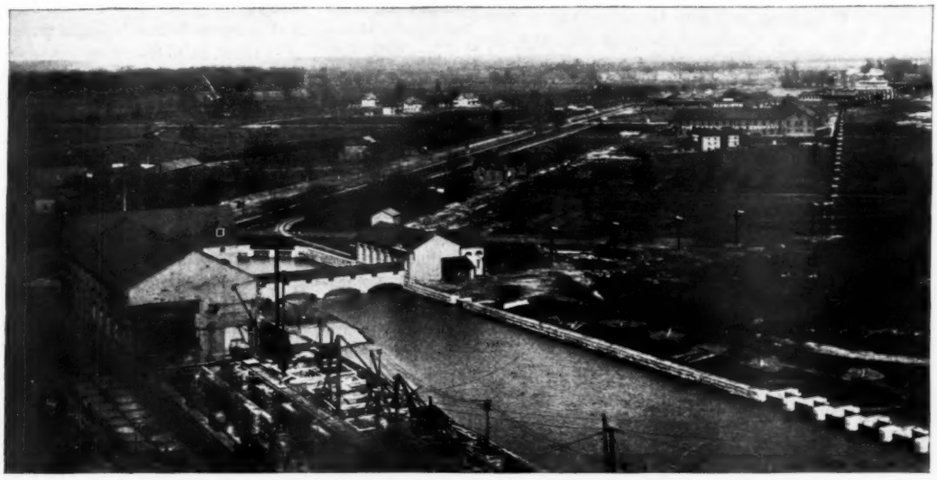
A number of the New York city aldermen were treated to a free ride last week on the two air-motor cars now running in 125th street. In the course of the evening, Alderman Noonan made the following inquiry of one of the officers of the air company: "How long does it take to charge one of these cars?" "About two minutes," replied the officer. "I think you could save at least 60 seconds by having it done in the aldermen's chamber," said Mr. Noonan.

William Hutcheson, a motorman at Colorado Springs, Colo., met his death last week as the result of a very unusual accident. Hutcheson acted both as motorman and conductor, and consequently was the only railway employé on the car. The trolley jumped from the wire, and the motorman went to the rear end of the car to replace it. When he shut off the current, by means of the controller on the front platform, Hutcheson evidently turned the crank too far and reversed the motor. He stepped behind the car, and the moment he replaced the trolley the car gave a lurch backward, striking him a terrific blow. He fell beneath the car and was crushed to death. One of two passengers who were in the car at the time, as soon as he realized that an accident had occurred, ran to the platform and pulled the trolley from the wire, thus stopping the car.

Last week a number of electrical experts from the Lynn factory of the General Electric Company went to Gloucester, Mass., with a party of Cuban sympathizers to try some dynamite experiments. They proceeded to Coffin's Beach, about seven miles from Gloucester, and planted 100 dynamite cartridges in the sand. Some recently devised electrical appliances were connected to the cartridges, the idea being to explode them all simultaneously. The experiment was a complete success. Just what the electrical appliances are can not be learned.

Mr. F. H. Thompson, an electrical engineer, who has been in Cuba for seven years as the manager of the Havana Gas and Electric Light Company, has returned to New York city. Mr. Thompson has had many interesting and exciting experiences, as his plant was located at San Antonio de los Barros, a town 21 miles from Havana and situated in the center of active operations of the insurgent forces in the province of Havana. Mr. Thompson states that one good reason why the Cuban war is not ended is that Captain-General Weyler is making a very large income.

Patrick Finn, of Jersey City, who, about a year ago, was thrown from a trolley car, sued the Consolidated Traction Company, of New Jersey, for $20,000 damages. When the suit was called for trial in the Supreme Court last week, the lawyer for the plaintiff announced that a compromise had been effected, and that his client had agreed to accept $5,000 in full settlement.



BIRD'S-EYE VIEW OF THE POWER DISTRICT AT NIAGARA FALLS, N. Y., SHOWING THE PRESENT GENERATING STATION, THE NEW WHEEL-PIT, THE BUFFALO TRANSMISSION LINE, THE ALUMINUM WORKS AND THE CARBORUNDUM PLANT. (This picture is from the first photograph of the kind ever taken.)

THE USE OF NIAGARA FALLS POWER.

INTERESTING FACTS ABOUT A GREAT AND GROWING POWER DISTRICT.

Although the Niagara Falls Power Company's station, at Niagara Falls, N.Y., has been in operation less than 20 months, it is probably unequaled by any other power station in the world in the variety of methods by which its power is being used to-day. Nor is this variety of methods more wonderful than the number and nature of the changes made with the electric energy to prepare it for the various uses to which it is applied.

At the main bus bars of the central station is supplied an alternating, two-phase current of 25 cycles, the pressure being kept at 2,200 volts. If we commence at the feeder switches, giving preference to that one whose meters are registering the greatest amount of power, we find that it is supplying the Pittsburgh Reduction Company.

At the works of this company is a transformer room belonging to the power company, in which are installed five 600-horse-power rotary transformers, supplied with alternating current at 130 volts from a double row of 10 static transformers, and furnishing nearly 15,000 amperes of direct current at a pressure of about 165 volts. This block of power is used to obtain aluminum, by electrolysis, from its oxide—alumina.

On the same set of feeder cables as the Pittsburgh Reduction Company is the Niagara Electro-Chemical Company, who use their block of 400 horse-power in much the same manner as the first-named company, the voltage being reduced and the current then changed to direct current at a pressure of 150 volts. This company is making

metallic sodium from the hydrate of sodium, just as the Pittsburgh Reduction Company makes aluminum from the oxide of aluminum.

Besides the power furnished to these two companies, there is a small block of about 50 horse-power furnished to the Acetylene Light, Heat and Power Company, or, as it is more familiarly termed, the Carbide Works. This power is used, by means of a 2,200 volt, two-phase induction motor, to drive the crushing, grinding, sifting and carrying machinery.

Taking the next feeder switch at the central station, we find that it is supplying the Carbide Works and the Carborundum Company. These companies use single-phase current and are run from opposite phases of the system in order to balance the station load. Each uses 1,000 horse-power at present, and applies it in the form of heat, their product being formed by chemical action, which takes place only at very high temperatures. Heat being the only requirement, a direct current is not necessary, but the voltage is lowered by transformers to from 100 to 150 volts. Here the resemblance between the two ceases. The Acetylene company uses an *arc* furnace to make calcic carbide from lime and coke. The Carborundum Company uses an *incandescent* furnace to make carborundum from sand and coke. In both cases the furnaces are the largest in existence.

Next in order among the feeder switches at the main station is the one supplying the Cataract Power and Conduit Company, or, as it is better known, the Buffalo transmission line. So much has been written about the transmission line lately that little need be mentioned here. The pressure being raised from 2,200 to 11,000 volts, and the system changed from two-phase to three-phase by the transformers at the Falls end of the line, the power is carried 27 miles to the Buffalo Street Railway Company's power house. There it is transformed down to 370 volts and changed to 550 volts, direct current, by means of rotaries. One thousand horse-power is being supplied at present, and, as it is used by the street railway system, we see that mechanical energy is the final form in which it is applied.

Coming finally to the fourth feeder switch, we find it supplying quite a number of consumers. One block of 500 horse-power is taken by the Buffalo & Niagara Falls Electric Light and Power Company, who have substituted two 300-horse-power, 2,200 volt, two-phase induction motors for their steam plant. This power is, of course, distributed in all of the different forms usually found in a city lighting plant, and is used in arc and incandescent lamps and in small motors.

The rest of the power supplied by the fourth feeder switch, except the small amount used for heating the station and for lighting the wheel-pit, is transformed to 575 volts, direct current, by static and rotary transformers placed in a corner of the power station.

The principal consumers of this power are the Buffalo & Niagara Falls Electric Railway Company and the Niagara Falls & Suspension Bridge Railway Company, the former using 300 horse-power on their trolley line from Tonawanda to the Falls, and the latter using 250 horse-power on the local system.

But there are also a number of small blocks of power distributed from this board, which are put to a great variety of uses and help to enforce the truth of the statement made at the commencement of this article. Among the consumers are a machine and foundry company, a lumber yard, artificial iceworks and the local waterworks.

There is one more outlet for the power generated at the central station; namely, the small rotary transformers, which supply current for exciting the dynamo fields. This current is also put to all manner of uses about the station—running the 50-ton crane, the wheel-pit elevator, arc and incandescent lamps in various places, water-gate motors, grindstones, turning lathes, and even being sometimes used to explode the dynamite when blasting in the wheel-pit extension.

Within a year several new factories will be located on the power company's land, taking blocks of power of from 300 to 3,000 horse-power, which will be used principally in electrolytic and chemical processes. The buildings of two of these companies—the Mathieson Alkali Company and the Albright-Wilson company—are about finished, and the machinery will be installed within a very few weeks. The first-named of these will use 2,000 horse-power and manufacture soda ash and bleaching powder by electrolysis. The other company will take 200 horse-power. It is difficult to foresee what the condition of affairs will be five years from now. Not only are new companies locating rapidly, but those already here are contemplating large extensions. The Acetylene Light, Heat and Power Company are nearly ready to use 5,000 horse-power, which will be used in their large addition to the original building.

This new building contains 25 furnaces, and when these are in operation the four that are now in use in the old building will be torn down and the space used for other purposes. The Carborundum Company will double the number of their furnaces shortly, which will also call for another block of 1,000 horse power.

Altogether it is safe to prophesy that the Niagara Falls Power Company will soon be taxed to its utmost capacity in order to make the supply of power equal to the demand.

A Large Railway Contract.

The contract for furnishing the motors and for altering the necessary coaches of the South Side Elevated Railroad, of Chicago, Ill., and converting them into motor cars, has been awarded to Mr. F. J. Sprague, of New York city. It is understood that 1,400 cars will be electrically equipped, and that Mr. Sprague's method of motor control will be used.

TELEPHONE NEWS AND COMMENT.

South Huron, Mich., claims to have more telephones in service in proportion to population than any other town in the State.

The Board of Aldermen, of Somerville, Mass., has adopted an order requesting the New England Telephone Company to provide the various city departments with free telephone service.

The annual meeting of the Northern New York Telephone Company was held on May 3 at 15 Dey street, New York city, and the following directors were elected: Benjamin F. Sargent, Fred C. Church, Chas. T. Crosby, Thomas Sherwin, John H. Cahill, David B. Parker and Geo. A. Roper.

At a meeting of the board of directors of the New York Telephone Company, held on May 6, the following officers were elected for the ensuing year: Charles F. Cutler, president; Joseph P. Davis, first vice-president; Edward J. Hall, second vice-president; John H. Cahill, secretary; William R. Driver, treasurer.

The City Council has passed the resolution charging the telephone company $5 per year license for each instrument in use in Ogden, Utah. To prevent the telephone company increasing the rates at present charged, the council amended the company's franchise so that the maximum rates charged by the company shall not exceed the present rates.

The local exchange of the Wisconsin Telephone Company, at Oshkosh, the second largest in the State, was rendered useless last week by the burning out of a distributing board from some unknown cause. No crosses with electric wires have been found. Five hundred telephones are rendered useless by the accident, leaving only 60 in operation, and all toll lines to the north and south were burned out.

At the annual meeting of the stockholders of the New York Telephone Company, held at No. 15 Dey street, New York city, on May 4, the following directors were elected: Charles F. Cutler, John H. Cahill, Joseph P. Davis, Thomas T. Eckert, William H. Forbes, George J. Gould, Edward J. Hall, John E. Hudson, John Jameson, James Merrihew, Charles A. Tinker, John Van Horne and William H. Wolverton.

A telephone company writes to the ELECTRICAL REVIEW as follows: "We are desirous of finding out if a line of poles originally built by one party, then rebuilt by another, can be claimed as the property of the party of the second part. Have there been any suits to recover possession of a line by the original builders? If so, can you give us the name of the case and when decision was rendered?" We shall be obliged to any of our readers who can give information on the subject.

On a ranch in California, telephone communication is established between the various camps, and also with the public system, by means of barbed wire fences. Insulators are not required; the lines are raised over the gateways. Thomas Flint, of San Benito County, who has this system in practical use, says that the wire fences will not carry as many connections as a single wire insulated, but that in a general way this novel telephone is a success. Other similar systems are reported from Texas.

The annual meeting of the New England Telephone and Telegraph Company was held on May 3 at No. 15 Dey street, New York, and the following directors were elected: Charles F. Ayer, John H. Cahill, Benjamin C. Dean, William H. Elliot, William H. Forbes, John E. Hudson, Henry S. Hyde, Albert O. Morgan, David B. Parker, Moses G. Parker, Stephen Salisbury and Thomas Sherwin. At a meeting of the new board of directors, held on the same day and at the same place, the following officers were elected: Thomas Sherwin, president; Henry S. Hyde, vice-president; William R. Driver, treasurer; Samuel W. Leedom, secretary; Jasper N. Keller, general manager.

American Institute of Electrical Engineers.

It is proposed to hold a subscription dinner on the occasion of the annual business meeting and election, which occurs on Tuesday, May 18. The price of the dinner has been fixed at $2. Guests may be invited. In addition to the routine business of the meeting, a paper will be presented by Dr. Alexander Macfarlane, and the paper on "The Synchronograph", presented at the meeting of April 21, will be taken up for discussion. It is the intention to call the meeting for 4 P. M., and adjourn for dinner at about seven o'clock.

American Society of Mechanical Engineers.

The thirty-sixth meeting of the American Society of Mechanical Engineers will be held at Unity Hall, Hartford, Ct., May 25 to 28. The programme includes a number of interesting papers, among which are the following: "Electricity vs. Shafting in the Machine Shop," by Chas. H. Benjamin, and "Electrical Power Equipment for General Factory Purposes", by Prof. Dugald C. Jackson.

OBITUARY.

Mr. Frank G. Beach, widely known in telephone circles, and for several years general manager of the Central Union Telephone Company, Chicago, died April 28, at his home in Evanston. Mr. Beach was a telephone pioneer and possessed a large circle of friends. His death was not unexpected, as he had been failing for several months, and the important affairs of his large telephone company have been largely under the efficient management of Mr. W. A. Jackson.

ATTACKING SAFES BY MEANS OF THE ELECTRIC ARC.

Some Facts About What Has Been Done.

BY C. E. KAMMEYER.

The persistency with which some people endeavor to maintain an untenable position, even after their error has been demonstrated to them, would seem to be worthy of a better cause. Ever since the writer's article appeared in the ELECTRICAL REVIEW,* a number of "expert opinions" have appeared in so-called technical journals, ridiculing, in effect, the idea that the modern burglar can, with comparatively little trouble and a minimum of paraphernalia, bore a hole through iron or steel walls *in a few minutes*. In none of these views or opinions did the authors claim that the thing is theoretically impossible, but they all tried to show, by figures, that the amount of current necessary would make it practically unfeasible for the burglar to accomplish in as many minutes what ordinarily would require that many hours, as admitted by even the safe manufacturers themselves. While it is admitted that to obtain the requisite amount of electrical energy from direct or alternating-current circuits might, in smaller cities, at least, involve more trouble and carry with it more danger of detection than the cracksman would care to risk, it certainly will not be denied by competent engineers that a set of storage batteries could easily be shipped to and set up in a convenient place, near a bank or business place, without exciting more suspicion than the arrival of a large sample trunk or a couple of carpenter's tool chests.

Those interested, and who care to investigate the subject further, will no doubt find food for reflection in the subjoined statement of Prof. J. K. Pumpelly, whose excellent reputation as an electrical engineer and storage battery expert is well known. Professor Pumpelly says:

"After reading, with close attention, the letter quoted in the *Electrical Engineer* of April 21, said to be written by Mr. E. G. Noe, superintendent of the General Electric Company, Chicago, on the non-feasibility of burglarizing safes by means of the electric arc, I had an opportunity of witnessing a practical demonstration of the act right here in Chicago. The act was performed with comparative ease, very rapidly, and with rather a crude arrangement of apparatus. Upon invitation to select the particular safe to be attacked, I selected one of the round, globe-like affairs that look and feel like a solid ball of steel, and as I afterwards found, was a steel casting, with a one and one-half-inch shell. One of the company's employés was asked to burn a hole through this shell.

"A spot on top of the globe was hastily cleaned with a bit of sandpaper; a flexible wire cable, equal to probably No. 0 wire, had its flattened end placed on the cleaned spot and held in place by a convenient chunk of iron, heavy enough to keep the cable in place. A piece of carbon rod, one and one-quarter inch in diameter, was next tied to a pine stick about two feet long, the stick serving as a handle to the electrode, to which another wire cable was clamped or tied. The two cables were easily connected to the positive and negative sides of the incandescent light service, through a resistance which reduced the pressure to 40 volts, and allowed 150 amperes, approximately, to pass, as was afterwards ascertained. A sheet-iron box, lined with asbestos, was placed against the side of the safe and the carbon rod passed through a hole in the box. This box, about eight by twelve inches and six inches deep, served as a screen to the eyes and face of the operator. I stood close to the safe, watch in hand, to time the operation, and the word being given, the 'burglar' pushed the carbon rod on to the surface of the steel. Of course, there was a bright light the instant the carbon touched the metal, but the asbestos box so shielded its intensity that no discomfort was felt by me or the operator. In one minute and eight seconds the carbon had been pushed through the steel, which seemed to yield like wax, and a hole one and one-half inch in diameter gave ample facility to get at the contents of the safe.

"Calculating the amount of electrical energy necessary to burn a hole of this size and depth, or, say, with a one-inch carbon, it will be found that 5,000 watts would be ample. In this particular case the carbon was held in constant contact, and even then a pilot lamp connected to the supply circuit did not show a flicker, nor was it dimmed.

"I have been asked whether or not a storage battery could be made to do this work, light enough to be comparatively portable, say under 300 pounds. I think it could. Possibly not to do it in such a rapid manner, or to burn such a large hole; but as the average time allowed a burglar 'to do a job' is four hours, as I am told, a battery large enough to do the work in four minutes will probably satisfy the burglar. Twenty-five cells of the old chloride type, weighing 12 pounds each, would give for four or five minutes 48 volts and 125 amperes, allowing for some slight resistance in circuit. So it seems to me that a man sufficiently expert, as a burglar fitting himself for this class of work soon would be, with 6,000 watts in his boxes', as 'Sleuth' would express himself, could soon burn several small holes through a safe. As the heat generated in burning through metal, by means of the electric arc, is always confined close to the point of contact, no inconvenience will be felt by the operator on that score, and the rather intense glare of the arc can, as already stated, be shielded by an asbestos-lined box.

"Of course, the storage battery would probably be useless after one or two operations, but that point Mr. Burglar cares little or nothing about; although a battery, chemically different from those now in common use, can be made which, I have every reason to believe, would stand such a heavy discharge, without injury to itself, for many operations."

The following letter, received by a Chicago firm in reply to its inquiry as to the feasibility of burning holes through iron safe or vault walls, is interesting, in view of the recent theoretical deductions tending to show how it *couldn't* be done:

"Replying to yours on the subject of using electricity for burning holes through safes and vaults, would state that, in my position as electrical superintendent of the Gates Iron Works, of this city, I have used during the past year, and still continue to use, an electric current and carbon for the purpose of burning off projections on steel castings. The method I employ is of the simplest construction. The articles published combatting the use of electricity for burning holes in steel safes and vaults are, to one that is practically familiar with the subject, amusing.

"From my experience I know that it is feasible to attack any steel vault or safe and burn a hole through it in a short time.

"By the use of an inexpensive storage battery, weighing not to exceed a bank burglar's ordinary kit, the contents of any safe or vault can be obtained in a very limited space of time. Electricity obtained from electric lighting, trolley or other electric system can, of course, be used, but it is my opinion that the storage battery means of attack will be the burglar's choice.

"Yours respectfully,

"(Signed) FRANK HOFFMAN,

"Elec. Supt. Gates Iron Works."

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* "The Modern Burglar," ELECTRICAL REVIEW, March 17, 1897.

WESTERN NEWS NOTES.

The Western Electric Company, Chicago, through one of its experts, Mr. Thos. G. Grier, has recently been making some exhaustive experiments on metals suitable for street-car journal bearings, with the result that the company is now prepared to furnish a long-wearing babbitt metal, which, it is claimed, is a great improvement on anything in this line heretofore placed on the market.

The Western Telephone Construction Company, of Chicago, has just completed some extensive changes in its quarters, whereby the floor space used has been doubled, and by an entire re-arrangement of the factory it is estimated that at least three times the former output of apparatus has been made possible. The offices also have been given more spacious accommodations to transact the clerical part of the business, and, taken all in all, it would seem a pretty strong indication of a profitable and increasing business being done by this company.

A satisfactory coloring for incandescent lamps has been long sought. The majority of lamp colors on the market are not more than half satisfactory, as they give a very poor imitation of genuine colored glass. The Electric Appliance Company, of Chicago, are placing on the market a new coloring, known as electrical chemical lamp coloring, which it is claimed colors the lamps in such a way that it is difficult to detect them from genuine colored-glass lamps. An examination of the work done with this coloring shows that it is a superior article.

The Standard Telephone and Electric Company, of Madison, Wis., report a decided improvement in business for the last 30 days. This company has closed contracts for no less than 20 installations during March and April. The exchanges vary in size from 25 to 400 numbers. Mr. J. J. Nate, the company's general superintendent, has just returned from an extended trip through the northwest, and while his trip was merely made in the interest of the company, with a view to better acquaintance with its patrons, he was favored with many substantial evidences of the quality of the Standard company's apparatus in the way of orders and gratifying reports of service furnished at all points visited. C. E. K.

American Street Railway Association.

The sixteenth regular (annual) meeting of the American Street Railway Association will be held in the Convention Hall, Niagara Falls, N. Y., October 19 to 22, inclusive, 1897. Papers will be read on the following subjects:

"Municipal Ownership of Street Railways."

"Modern Electric Railways; their Construction, Operation and Disadvantages."

"Application of Electricity to Railroads now Operated by Steam Power."

"The Best Method of Settling Damage Cases, and the Prevention of Accidents by the Use of Fenders and Otherwise."

"Producer Gas for Use in Street Railway Power Houses and Gas Engines."

"Storage Batteries for Street Railways."

"Discipline of Employés."

"Long-Distance Transmission and the Use of Multiphase Current for Ordinary Street Railways."

There will be a large exhibition of street railway supplies. A large building, 120 by 154 feet, is being erected for this purpose, with plenty of power, light and heat. The meetings will be held on the second floor of the building.

The Traffic Associations have authorized the sale of tickets at reduced rates; namely, a fare and one-third for the round trip, but at least 100 tickets must be purchased and presented to the clerk at Niagara Falls before concessions will be granted.

A New Electric Light Supply Catalogue.

Messrs. Stanley & Patterson, the well known electrical supply dealers and manufacturers, of New York, have just issued a noticeably complete and thoroughly illustrated catalogue. It is an electric light supply catalogue of 272 pages, enveloped in a striking cover. Over 3,000 different articles have been listed, representing everything needful for a complete electric light plant. The catalogue will be sent on application.

Stanley & Patterson are also getting out another catalogue that will soon be ready, covering the electric bell, telephone, telegraph and general supply branches.

Injunction Against the Underground Trolley.

Justice Smyth, of the Supreme Court, of New York, has granted an injunction, pending argument, upon the application of the Forty-second Street, Manhattanville & St. Nicholas Avenue Railway Company restraining the Metropolitan Street Railway and the Belt Line Railway companies from constructing their underground electric railway conduit across or under the tracks of the plaintiff company in New York city.

A jury in the Supreme Court in Brooklyn, N. Y., gave a verdict against the Brooklyn Heights Railroad Company for $1,750 in the suit of Louis Doht, a brother of Sheriff Doht, of Queens County, for injuries received in a trolley acoident.

The Efficiency of the Heilmann Electric Locomotive.

To the Editor of Electrical Review:

Your issue of April 21 contained a description of the Heilmann locomotive, which stated that 73.4 per cent of the power indicated in the steam engine cylinders was recovered at the rims of the drivers, and that, when the locomotive was moving on a level at 62 miles per hour, 48.4 per cent of the power indicated in the cylinders would be recovered at the draw-bar, which would haul 350 tons on bogies at the rate of 62 miles per hour.

In commenting on these figures, editorially, you said, "The efficiency of the locomotive is stated to be 48.4 per cent, which makes a bad comparison with the B. & O. locomotives in the Belt Line tunnel. The average street-railway motor is good for 80 per cent and, under favorable conditions, 90 per cent efficiency."

This editorial is so unfair to the Heilmann locomotive and so entirely misleading to your readers, who may not have examined the figures carefully, that I take the liberty of addressing this letter to you, hoping that you will either correct or justify your editorial criticism.

Being the inventor of the patented system of transmission of power employed on this locomotive, for which I claim the highest instead of the lowest efficiency, I naturally like to see it accorded fair play.

You do not explain how it is possible for the B. & O. locomotive to have a higher efficiency, but merely quote the efficiency of a street-car motor as being 80 per cent.

If the efficiency of the motors alone were decisive, I might answer that the efficiency of the motors on the Heilmann locomotive, as stated by the article you yourself quote, is 90 per cent.

But, of course, it is entirely misleading to draw any conclusions from the efficiency of the motors only.

As a matter of fact, the recovery at the draw-bar of 48.4 per cent of the indicated power, under the conditions stated, is extremely high. Tests by the Pennsylvania Railroad Company, taken at 65 miles per hour, showed an efficiency for one of their highest-class locomotives of 42 per cent.

I do not see how the B. & O. locomotives can possibly show as good efficiency as the Heilmann locomotive, under similar conditions. The steam-engine can not show much, if any, superiority in efficiency over the Willans engines, which give 90 per cent. The generators are not likely to show an efficiency higher than 95 per cent, shown by the Brown generators on the Heilmann locomotive. There is certainly much more loss in the conductors at Baltimore than two per cent, which is the conductor loss on the Heilmann, and it is not likely that the motors will show a higher efficiency than 90 per cent, which is what the Brown motors show. It therefore seems evident that the advantage is with the Heilmann locomotive, rather than the B. & O. locomotives.

It seems as though you must have fallen into the error of assuming that the 48.4 was the recovery at the rims of the drivers, instead of at the draw-bar. At the driver rims, the efficiency, in the case of the Heilmann, is stated as 73.4 per cent.

A point you did not mention is that the first cost of the B. & O. locomotive plant was probably, at least, five times as much as equivalent Heilmann locomotives, and that the number of employés required to run it is probably about in the same ratio. While these matters are not strictly involved in the efficiency of the conversion, they will no doubt have their effect upon the cost per ton mile hauled.

Hoping that you will show more clearly than you did by your editorial, wherein the Heilmann makes a poor showing, I remain,

Yours very sincerely,

H. Ward Leonard.

East Orange, N. J., April 22.

The Bryant Weatherproof Socket.

The Bryant Electric Company, of Bridgeport, Ct., are placing upon the market a new weatherproof socket, which is shown in the accompanying illustration. They call it their No. 1,104, and it is made in Thomson-Houston and Westinghouse styles. The particular advantages claimed for this new Bryant socket are the method of sealing in the wires, which makes it absolutely weatherproof, and the length of the porcelain skirt at the bottom, which is unusually long, fully covering the lamp base.

The Bryant Weatherproof Socket.

Western Union.

A director of the Western Union Telegraph Company is quoted as saying, regarding the unfavorable rumors about the company's condition and prospects, that most of these stories are fabrications. The business of the company shows an improvement as compared with last year, and he further states that there is no prospect of any reduction in the rate of the company's dividend, either at the end of the quarter that began April 1, or at any later date. The company's relations with the American Bell Telephone Company are not inharmonious, and competition with the Postal Telegraph company appears to be worrying the bears more than it does the Western Union. In a word, the Western Union seems to be improving everywhere, except in Wall street. Of the $100,000,000 of the Western Union capital stock, only $5,000,000 is in the names of brokers. The stock is going out of these names rapidly.

Photographic Energy of the Light of Fire-Flies.

[*From the London Lancet.*]

A very interesting investigation of the luminous and other radiations emitted by fire-flies has just been published in the ninth volume of the *Journal of the College of Science*, Imperial University, Tokio, Japan. The author, Mr. H. Muraoka, who writes in German, is professor of physics at Kyoto. He mentions that the spectacle produced by the fire-flies about the middle of June is one of the sights of the place, and he states that the present inquiry was suggested to him by the resemblance of their light to that of fluorescent bodies, some of which have been shown by H. Becquerel to emit radiations possessing properties analogous to those of the Roentgen rays. The flies are most luminous from about 6 P. M. to 11 P. M. The experiments were made by placing a number of them, varying from 300 to upwards of 1,000, in a small, flat box in which they were confined under a net made of hemp ("deren Wegfliegen mit einem Hanfnetz verhindert wurde"). The box also contained a photographic dry plate, in contact with which were plates of various metals (copper, aluminum, zinc and brass), all of similar thickness, sheets of cardboard, both entire and also with cruciform patterns cut out of them, being sometimes interposed between the sensitive plate and the metal, and sometimes used alone with the sensitive plate. Thin wooden boards were also employed for the same purpose. The sensitive plate and the objects in contact with it were wrapped in several thicknesses of black paper and left in the box with the flies for two nights. The experiments were made in a photographic dark room, sunlight and artificial light being carefully excluded. The sensitive plates, though thus wrapped up, and additionally protected by metallic plates and layers of cardboard, gutta-percha, cloth, silk, etc., were always more or less blackened. Professor Muraoka makes frequent reference to the papers published in *Nature* in the early part of 1896 by Dr. John Macintyre, of Glasgow, and Mr. J. J. Thomson. His experiments led him to the following conclusions: 1. The light of the flies in its original state behaves like ordinary light. 2. The light contains rays which pass through cardboard, metal plates, etc., and possesses properties analogous to those of Roentgen rays or Becquerel's fluorescent rays. 3. When the photographic plate is covered with layers of cardboard, it presents an appearance which calls to mind the permeability of iron to magnetic lines of force. 4. The properties of these "filtered" rays appear to be influenced by the materials through which they have passed; perhaps by the thickness of the materials. 5. The properties possessed by the radiations, and specified under No. 2, are apparently non-existent, or, at least, undiscoverable until after "filtration". The Roentgen rays are similarly undiscoverable until after "filtration"—i. e., through the glass of the Crookes tube—and "filtration" may perhaps afford a means of rendering the X rays homogeneous. 6. The "filtered" fire-fly rays undoubtedly admit of reflection. Refraction, interference and polarization could not be demonstrated, but Professor Muraoka is of opinion that they take place. 7. The "filtered" fire-fly rays seem to resemble Becquerel's fluorescent rays in possessing properties intermediate between the ultra-violet rays and the Roentgen rays. The volume of the *Journal of the College of Science*, in which this article appears, contains over 200 pages; all the other papers are in English, and are mostly chemical, except four, the subjects of which are electricity, magnetism, geology and astronomy.

A Satisfactory Year for the Erie Telegraph and Telephone Company.

In the annual report of the Erie Telephone Company, a statement is made showing the principal assets of the company to be 65 per cent of the capital stock of the Cleveland Telephone Company, capital, $1,700,000; 70 per cent of the capital stock of the Northwestern Telephone Exchange Company, capital, $2,000,000, and 70 per cent of the capital stock of the Southwestern Telegraph and Telephone Company, capital, $3,000,000.

From the report we abstract the following:

The number of subscribers during the year increased 2,798 to 21,389; total number of exchanges increased two to 65.

The year 1896, notwithstanding the general unsatisfactory condition of the business of the country, shows a greater increase, comparatively, than any previous year.

The expenditure upon the plant and equipment during the year has been $1,234,414, of which $828,317 was for new construction. The company owns real estate in various cities in the South and in the West, valued at $440,000.

There is now being constructed for the company's use at Minneapolis a building that will cost, with the land, about $125,000. Permanent locations at Dallas and Fort Worth are also under consideration.

The sub-companies now have 11,808 miles of wire working under ground, of which 7,395 miles are in the city of Cleveland, Ohio.

In the northwest there is in operation 5,054 miles of long-distance wire. In the southwest there is in operation 6,458 miles of long-distance wire. The grand total number of miles of wire in operation is 43,032.

It is estimated that the total expenditure for extensions of the plant and real estate for 1897 will be $700,000. To provide for extensions, stock of sub-companies is sold from time to time. To December 31, 1896, this increase has been 40,429 shares, with par value of $2,971,450.

Peter Sceiber, of Huntington, Ind., has sued the telephone company because a bolt of lightning followed a wire they left attached to his desk, and he was injured. He asks for $5,000 damages.

THE WARREN ELECTRIC MANUFACTURING COMPANY.

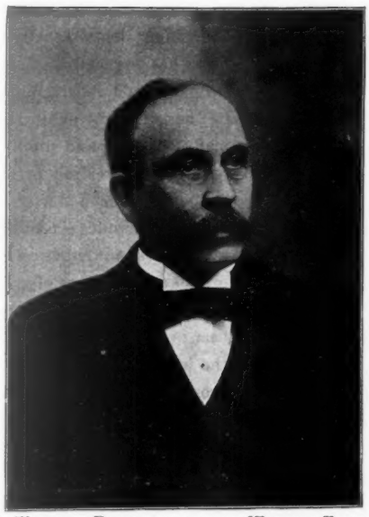
ITS OFFICERS AND PLANT.

The establishment of the Warren Electric Manufacturing Company, at Sandusky, Ohio, adds a large manufacturing plant to the growing electrical industries of the middle West. The plant, heretofore known as the Barney & Kilby Engine and Machine Works, is in the center of the city of Sandusky, occupying over half of one entire city block, two squares from the post office. This company is a successor to the Warren Electric Company, of Chicago, the business having been done heretofore from Chicago by the latter-named company. It is only recently that the "Warren" alternator, which they are manufacturing, has been thoroughly and finally perfected. The change of location was made with the view of having larger and better manufacturing facilities than could be economically secured in a city like Chicago, and the element of transportation was considered, as the new factory is in close connection with every trunk line of the United States by five lines of railway, and also by Sandusky's magnificent Lake Erie harbor. Still another element contributing to the desirability of this location is in the fact that its situation is in the heart of the metal and coal markets.

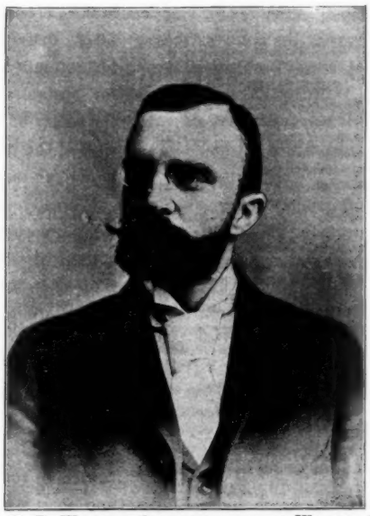
The Warren machines have heretofore been built by contract, but the plan was not entirely satisfactory, and a search for suitable manufacturing facilities has resulted in the organization of a manufacturing company and the purchase, upon exceptionally favorable terms, of the Sandusky plant.

The Warren Electric Manufacturing Company has a full-paid capital of $200,000. As will be seen by the illustration of the plant, the buildings are substantially constructed of stone, and are excellently arranged for their purpose. The factories are splendidly equipped with modern tools and machinery made especially for the construction of the Warren alternator.

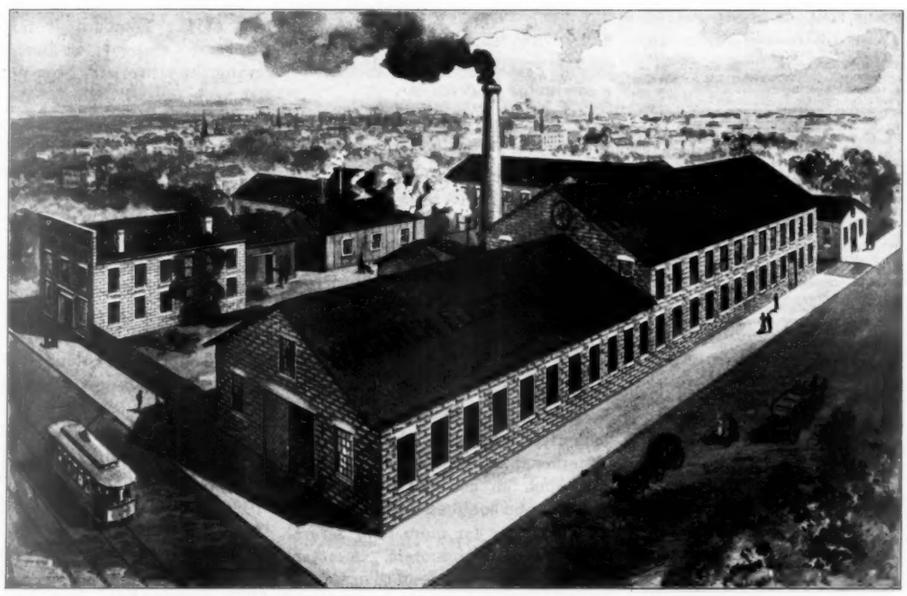
The success of the machine is now fully established, and it is in successful operation in Florida, New Jersey, Pennsylvania, New York, Ohio, Illinois, Indiana, Iowa, Minnesota, Colorado, Arizona, California, and even Japan. The officers of the company are C. C. Warren, president; James F. Kilby, of Cleveland, vice-president; H. B. Warren, secretary, and Charles F. Mack, of Sandusky, treasurer. Mr. C. C. Warren has been prominently known for many years in the electrical business. His experience in commercial enterprises before entering the electrical field gave him considerable advantage over many of his contemporaries, he having been identified with a number of business movements throughout Ohio and the West. He was the organizer of a bank at Three Rivers, Mich., was interested in the wholesale coffee business at Toledo, Ohio, and in a number of mercantile matters in Cleveland. In 1880 he organized the Citizens' Electric Company in Toledo, which was among the first electric lighting companies to be incorporated in the State of Ohio, and in 1882 he took up the management of the western department of the United States Electric Lighting Company, with offices in Chicago. It is generally known that the growth of the western business of that company was phenomenal under his management. Shortly after the United States Electric Lighting Company turned its business over to the Westinghouse company, Mr. Warren took up the management of the Central States district for the Edison company, remaining in charge until the early part of 1890, when he resigned, for the purpose of organizing a railway department for the Westinghouse company, of Pittsburgh. After his resignation from the Westinghouse company, it was his intention to stay out of the electrical business; but he did not withstand its allurements, and four years ago undertook the development of the alternating-current system, in connection with his son, Mr. H. B. Warren, and the result is seen in the present Warren alternator, the demand for which has made necessary the large plant.



MR. C. C. WARREN, PRESIDENT OF THE WARREN ELECTRIC MANUFACTURING COMPANY.



MR. H. B. WARREN, SECRETARY OF THE WARREN ELECTRIC MANUFACTURING COMPANY.



PLANT OF THE WARREN ELECTRIC MANUFACTURING COMPANY, AT SANDUSKY, OHIO.

The secretary of the company, Mr. H. B. Warren, son of C. C. Warren, who is the inventor of the Warren alternator, received his education in Toledo, and since boyhood has shown a liking for the subject of electricity, and when, in 1882, his father took the western management of the United States Electric Lighting Company, he took charge of a large department of the commercial work. Beginning with the installation of a plant in the St. Louis post office, which at that time was considered an excellent equipment, he took charge of the construction business of the southwest, locating at Kansas City, where he installed many important plants. A year or two later the growth of business compelled his removal to St. Paul, to take charge of the construction department of the northwest, where he continued until the United States Electric Lighting Company went out of business, at which time he engaged with the Thomson-Houston company as its electrical expert, remaining with it until the consolidation known as the Northwestern General Electric Company, with which he remained in a similar capacity until 1893, when that company was wound up.

It may be said that Mr. H. B. Warren is by nature an electrical engineer, as he received no technical schooling, but from childhood has been a student of electrical literature of a technical character, being most interested in lighting and transmission work, and the mechanical and electrical problems of dynamo performance. He kept in close touch with all advances and developments in these lines, and was early fascinated with alternating-current phenomena and possibilities. As a natural consequence of such sustained interest in the alternating-current branch of the electrical business, he embraced the first opportunity to enter the field of machine construction, and in the Fall of 1893 he went to Chicago and commenced working up the design of an alternating-current generator, which has already acquired fame as the Warren alternator.

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Special Notice to Advertisers.

***CHANGES** for advertisements must be in this office by Friday noon for the following week's issue.*

***NEW ADVERTISEMENTS** should be in the office not later than Saturday noon to insure publication on the following week.*

NEW YORK, MAY 12, 1897.

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We call the attention of our readers to the interesting illustration published on the first page of this issue of the ELECTRICAL REVIEW. It shows a bird's-eye view of the extensive power district in the immediate vicinity of the Niagara Falls Power Company's generating station. The photograph, from which the illustration was reproduced, is the first of its kind ever taken, and was made by a staff correspondent of the ELECTRICAL REVIEW from the top of a recently completed chimney.

ONE-MAN TROLLEY CARS.

We believe the principle of economy can sometimes be carried to a stage of refinement which is apt to prove dangerous and, in the long run, unprofitable. A few railway companies are doing business with cars intrusted to the care and watchfulness of one man, who is expected to handle the brakes, control the motors, collect the fares, distribute transfers, give information to passengers and watch for obstacles, and be ever alert for the safety of his passengers as well as that of the pedestrian public—truly a herculean task for one man.

We advocate the trolley car in every reasonable fashion, but, we submit, it is too much to expect of a motorman to be his own conductor. There are too many risks involved, both to the passengers and public. An accident now and then happens, the cost of which would several times pay the wages of the conductors required for a year or more. Only a few small roads attempt the practice, and it is a shortsighted policy even for them. They have graduated from the old bob-tail fare-box and put on the more pretentious plumes of the trolley, but have carried their old habits along. In some cases, in our own State, we understand, the State Board of Railroad Commissioners has consented to the continuance of the practice after electric traction has been installed. It is a mistake and should be corrected by a mandate, ordering all such roads to place a conductor on every car.

A recent case appeals very strongly for such a mandate. One of these cars, operated by a combined motorman and conductor, was switched at the top of a grade, and in the switching the trolley came off the wire. The motorman, in his excitement, reversed his controller without opening the controller circuit, and jumped off to restore the trolley. The instant circuit was established, the car started backward, ran over and killed the motorman, and no one remained to look after the safety of the passengers. Whether the facts were as stated or not, such an accident could easily happen, and could easily cost the railway company far more than several years' wages of conductors. A motorman has all he can attend to in managing the movement of the car, the stops, and observing the track ahead, crossings and sidewalks for other passengers. Beyond this he should not be called on, as his activity is taxed even then. Collecting fares, giving transfers, answering questions, and the many other duties, should be done by a conductor, who can also look after the trolley and man the rear brake in an emergency.

We believe the subject is one worthy of the immediate consideration of the State Board.

THE NATIONAL ELECTRIC LIGHT ASSOCIATION'S CONVENTION.

The Niagara Falls convention of the National Electric Light Association, which will occur on June 8, 9 and 10, promises to be a splendid one in every way. From present appearances the hotel facilities of the city will be taxed to their full capacity to accommodate the electrical people and their friends. One company alone has engaged 40 rooms in one of the principal hotels. While there will be no distinct exhibition, all the manufacturing and supply companies will have interesting private exhibits at their own headquarters. The programme includes a number of highly instructive addresses which should provoke discussions of great practical value. The social features have not been neglected, and, taken as a whole, the coming convention will surely prove to be one of the best ever held. Just at the beginning of the new era of prosperity, this meeting will afford every one in the electrical field an opportunity to renew acquaintances and lay out new business plans.

PERSONAL.

Mr. B. F. Miles, of the National Carbon Company, Cleveland, Ohio, visited New York city last week.

Mr. J. S. Crider, of the Washington Carbon Company, Pittsburgh, was a visitor in Greater New York last week.

Mr. Allan V. Garratt, chief engineer of the Lombard Water-Wheel Governor Company, of Boston, was among the visitors to New York city last week.

Mr. E. W. Little, of New York, was a Boston visitor last week, on business relating to a new company that will soon enter the electrical field. Mr. Little will be actively interested.

Paul W. Bossart, secretary of the American Electric Telephone Company, of Chicago, is making a business trip through the South, and will stop at the Tennessee Centennial to look after the installation of the exhibit to be made by his company.

Mr. Henry D. Stanley, for many years at the head of the extensive electric wire department of the Bridgeport Brass Company, and more recently connected with other manufacturers of insulated wire, has joined the staff of the National Conduit and Cable Company, of New York, and and will hereafter look after the cable department of this successful and enterprising company.

Out-of-town visitors were registered at the headquarters of the National Electric Light Association for last week, as follows: M. E. Baird, Windsor, Ct.; W. E. Sharps, J. L. Fannon, H. T. Paiste, H. B. Cutter and F. W. Darlington, Philadelphia, Pa.; F. O. Briggs, Trenton, N. J.; David Bloch, city of Mexico; L. B. Stillwell, Pittsburgh, Pa., and Mr. Mooney, Poughkeepsie, N. Y.

SUPPLEMENT TO

Electrical Review.

NEW YORK, WEDNESDAY, MAY 12, 1897.

THE BERLINER CASE.

The long-pending litigation, begun by the United States Government to cancel the Berliner transmitter patent, issued in 1891 and owned by the American Bell Telephone Company, was concluded on Monday of this week. The Supreme Court, with but one dissenting vote—that of Justice Harlan, Justices Gray and Brown not sitting—sustains the regularity of the Berliner patent.

Judge Carpenter, United States Circuit Court judge, on December 18, 1894, in a suit brought by the United States Attorney-General to annul the patent, decided that it was void, on the grounds that a similar patent had been issued to Berliner, November 2, 1880, and that there was illegal delay in its issue. This decision was reversed by the United States Circuit Court of Appeals, May 18, 1895, and now the Supreme Court sustains the Court of Appeals.

The patent therefore stands as properly issued, and will undoubtedly be attacked on its merits by the telephone companies opposed to the Bell interests. It is claimed to cover the various forms of battery transmitters, and is supposed to be an extension for 12 years of the control so long enjoyed by the American Bell Telephone Company.

The ELECTRICAL REVIEW presents the decision at length and also several interviews. It is evident that the independent telephone companies have anticipated this result and are prepared to promptly test the validity and scope of the patent.

The Bonta make-and-break transmitter patents, which are not owned by the American Bell Telephone Company, will come in for a large share of attention now that the Berliner decision has been rendered. There are some other patents that will have to be considered.

Every telephone man, whether entirely happy or not, should be glad that the Berliner case is at last decided.

BELL COMPANY WINS.

A Decision in Their Favor in the Berliner Case.

THE UNITED STATES SUPREME COURT DECIDES THAT THE GOVERNMENT FAILED TO SHOW CORRUPTION OR UNNECESSARY DELAY—DECISION BY JUSTICE DAVID J. BREWER, JUSTICE HARLAN ALONE DISSENTING, JUSTICES GRAY AND BROWN NOT SITTING—HISTORY OF THE CASE AND TEXT OF THE DECISION—OPINIONS OF INTERESTED PARTIES.

THE PATENT TO BE ATTACKED ON OTHER GROUNDS BY THE OPPOSITION TELEPHONE COMPANIES.

The celebrated case of the United States vs. the American Bell Telephone Company was finally concluded on Monday of this week, the United States Supreme Court deciding in favor of the defendant. This case was a remarkable one, for, aside from the vast financial interests involved, it ranks as a *cause celebré* by reason of the almost unprecedented action of the government in initiating a suit to invalidate a patent issued by itself in due form.

The patent was granted Emile Berliner November 17, 1891, assignor to the American Bell Telephone Company, application having been filed in the Patent Office in 1877. The government asked the repeal of the patent on the grounds that there was illegal delay in its issuance and that Berliner's prior patent, granted in 1880, was for the same invention.

Judge Carpenter, of the United States Circuit Court, at Boston, decided in December, 1894, against the patent and in favor of the government. On appeal to the United States Circuit Court of Appeals this decision was reversed May 18, 1895. The case afterwards went to the United States Supreme Court, was exhaustively argued, and, after more than a year's time, it is now decided that the patent is valid, and virtually stands on its merits as any other patent issued by the United States Patent Office. This patent is supposed to cover all forms of battery transmitters, and was published in full in the ELECTRICAL REVIEW of May 22, 1895.

The decision was written by Justice D. J. Brewer, Justice Harlan dissenting, and Justices Brown and Gray not sitting. The conclusions follow:

THE SUPREME COURT STATEMENT.

Mr. Justice Brewer:

I am directed to deliver the opinion of the court in No. 344, the United States vs. the American Bell Telephone Company and E. Berliner.

This was a bill filed by the government to set aside a patent issued to the telephone company as the assignee of Berliner on a patent issued in 1891. The grounds of relief set forth in the bill are that the delay of the application in the office for 13 years was, under the circumstances alleged in the bill, unlawful and fraudulent; that the invention embraced in the patent of 1891 was included within a patent issued in 1880, and that the patent as issued was not for the invention described in the application, and also that taking the application to date, from the time when it was made by amendment to cover the invention described and claimed, it was barred by public use for more than two years.

We hold in this respect, to a suit to set aside a patent for an invention, that as in cases brought to set aside patent for land, the government must establish the grounds of relief by testimony which is clear, convincing and satisfactory, and not upon a mere preponderance of testimony.

We also hold that there is no evidence in the record—not the slightest—that there was any corruption or undue influence exercised by the officials of the telephone company to secure any delay in the Patent Office; that there is no evidence which justifies an inference that the delay was either at the instance or with the procurement or at the solicitation of the telephone company, or its officials, and that whatever delay there was, was caused by the action of the officials of the Patent Office, for which the telephone company is not responsible.

We hold, therefore, that there is an absolute failure to show any wrong on the part of the telephone company in this delay in the Patent Office, and as to the other grounds of attack, they are matters which, under the statute law, are open to every individual to set up in a suit brought against him by the holders of the patent, and that so far as these particular matters are concerned, they are not such as to justify the interference of a court of equity to set aside the patent.

The decree of the court below is affirmed.

Mr. Justice Gray and Mr. Justice Brown did not hear the argument and took no part in the decision of this case.

Mr. Justice Harlan dissents.

How an Abstract of the Court's Opinion Was Secured by the Newspapers.

Owing to the fact that Justice Brewer's opinion was rendered "in the rough", the court refused to allow it, or any part of it, to be copied and published verbatim. Only three newspaper men were permitted to look at the opinion, and a clerk stood over them to see that they obeyed the orders about copying the document. These three men were the agent of the Associated Press, a reporter for the Washington *Evening Star* and the correspondent of the ELECTRICAL REVIEW. They were told to read over the opinion and then write their own reports of it.

THE OPINION IN ABSTRACT.

HOW THE DECISION WAS RECEIVED—A REVIEW BY THE ELECTRICAL REVIEW'S WASHINGTON CORRESPONDENT.

SPECIAL DISPATCH TO ELECTRICAL REVIEW:

WASHINGTON, D. C., May 10.—About a dozen inventors, attorneys and other persons especially interested in the Berliner telephone case, and who have been regular attendants upon the Monday sessions of the United States Supreme Court during the last seven months, received their rewards—and punishments—to-day. The decision was announced by Justice Brewer. He went straight to the heart of the matter, and, in most emphatic and unmistakable language, declared that the government had made no case, and that the Berliner patent should not be canceled.

The written opinion is quite lengthy, and deals with the various points brought forward by the government in its attack upon the patent, the Patent Office officials and the Bell Telephone Company's attorney, in detail and with great clearness and force. The contention that Berliner's patent of 1891 is covered by his patent of 1880 was disposed of with the statements that the question is not open for consideration in this case, because this objection is a defense which is open to every individual charged by the patentee with infringements, whether the proceedings against him be an action at law or a suit in equity. The judgment of the Patent Office was adverse to the contention of the government on this point, and this judgment can not be reviewed in this case.

The opinion declares that the right of the government to maintain a suit of this character has, heretofore, been affirmed, and discusses the difference between a land patent issued by the government and a patent for an invention, in order to show light upon the question, and states, in substance, that there are weightier reasons for canceling a patent for land, which the government absolutely disposes of to the purchaser, than a patent for an invention which is of a temporary character, and which, after a brief time, will be free to all. As applicable to this case, Justice Brewer quotes from a decision of Justice Miller in a noted land case as follows:

"The general doctrine is when, in a court of equity, it is proposed to set

aside, to annul or to correct a written instrument for fraud or mistake in the execution of the instrument itself, the testimony on which this is done must be clear, unequivocal and convincing, and that it can not be done upon a bare preponderance of evidence which leaves the issue in doubt. If the proposition is sound in regard to the contracts of private individuals, how much more should it be observed when the attempt is to annul the grants, the patents and other solemn evidences of title emanating from the government of the United States, under its official seal. In this class of cases, the respect due to a patent, the immense importance and necessity of stability of titles dependent upon these official instruments, demand that the effort to set them aside, to annul them, or to correct mistakes in them, should only be successful when the allegations on which this is attempted are clearly stated and fully sustained by proof. It is not to be admitted that the titles to so much property in this country, purporting to emanate from the authoritative action of the officers of the government, shall be dependent upon the hazard of successful resistance to the whims and caprices of every person who chooses to attack them in a court of justice; but it should be well understood that only that class of evidence which commands respect, and that amount of it which produces conviction, shall make such an attempt successful."

The court holds that these declarations of law control in this case, and after reciting the history of the patents granted to Bell and Berliner, and quoting at length from the arguments of the government counsel charging that there was improper delay in the Patent Office, says that the mere fact of delay does not operate to deprive the inventor of his legal rights, and that the course he must follow to obtain his rights are clearly established by law. In this case no delay has been caused by the representatives of the Berliner application. The Patent Department was established by Congress, put in charge of officials selected by the government, to whom all applications for patents must be made, has fixed the terms and conditions of such applications, and placed the entire management of the affairs of the department in the hands of those officials, and when an applicant complies with the conditions and files his application with the officers of the department he must abide their action and can not be held to suffer or lose his rights by reason of any delay on the part of those officials, whether reasonable or unreasonable, unless such delay has been caused through his corruption of the officials. There has not been the slightest evidence presented in this case tending to show, in the least degree, any corruption by the applicant of any of the officials of the Patent Office, or any undue or improper influence exerted, or attempted to be exerted upon them, and, on the other hand, the evidence does show that the Bell Telephone Company urged promptness on the part of the officials of the department, and that the delay was the result of the action of those officials who acted according to law and are free from all censure. The government has absolutely failed to produce a scintilla of testimony as to any corruption of the officers of the Patent Office, or any attempt at such corruption. The names of the examiners and attorneys connected with the Berliner application are given, their actions are carefully analyzed and every one of them found free from blame.

The argument that a patentee occupies the position of a quasi-trustee for the public, was met with the emphatic declaration that an inventor is one who has discovered something of value, and that it is his absolute property. The philanthropic idea that the government should cancel a patent whenever it is liable to prolong a monopoly, was disposed of with equal promptness and emphasis.

Justice Brewer says the telephone invented by Bell is now free to the public and everybody may use it, but the public is not satisfied with it and insists on having the better instrument, which is controlled by Berliner's patent. When the Berliner patent expires there may be still better patented instruments and the monopoly may be continued, but each invention is an independent and distinct piece of property, and the rights of the individual inventors are not abridged because several inventions are used in combination by the same corporation.

The court holds that the government has a right to cancel a patent when it has a proprietary or pecuniary interest in the result, and when it is necessary to enable it to discharge its obligation to the public; but, in this instance, it is apparent that one of the purposes of the suit was the striking down of the Berliner patent in order to give value to others; that private competitors of the Bell company are seeking to injure a rival, not for the public good, but for the promotion of their personal interests.

The decision of the Court of Appeals was affirmed; Justice Harlan dissented, but delivered no opinion. Justices Gray and Brown took no part in the case. GEO. C. MAYNARD.

WHAT THE INDEPENDENT TELEPHONE COMPANIES HAVE TO SAY.

The ELECTRICAL REVIEW, on receipt of the news of the decision from its vigilant Washington correspondent, telegraphed to the leading independent telephone companies and the American Bell company, requesting their opinion by wire of the Berliner decision.

We publish below the replies received.

FROM THE AMERICAN ELECTRIC TELEPHONE COMPANY.

SPECIAL DISPATCH TO ELECTRICAL REVIEW:

Simply a moral victory. Berliner patent now adjudged owned by Bell company has expired and never was valid; very weak and can be easily beaten, if suit is ever brought by Bell company, which is improbable. The Supreme Court decision on the question of fraud will be used by the Bell company to dignify the patent and to further intimidate capital. Some people would stop eating bread if Bell company claimed a patent on flour. We will sell and build more prosperous exchanges than ever.

AMERICAN ELECTRIC TELEPHONE COMPANY.
Chicago, May 10.

FROM THE OWNER OF THE LOCKWOOD TRANSMITTER.

SPECIAL DISPATCH TO ELECTRICAL REVIEW:

The Berliner decision will be rough on those companies using any form of contact telephone, but a variable air space between electrodes, such as possessed by the Lockwood transmitters, will permit the opposition or local companies to continue in existence. JOSIAH TICE.
New Brunswick, N. J., May 10.

FROM THE KEYSTONE TELEPHONE COMPANY.

SPECIAL DISPATCH TO ELECTRICAL REVIEW:

We expected this result. We can guarantee, however, that a final decision on the validity of this patent will be in our favor.

KEYSTONE TELEPHONE COMPANY.
Pittsburgh, May 10.

FROM THE FARR COMPANY.

SPECIAL DISPATCH TO ELECTRICAL REVIEW:

Think Berliner decision can not damage local companies in any way.

FARR TELEPHONE AND CONSTRUCTION SUPPLY COMPANY.
Chicago, May 10.

FROM PRESIDENT KEELYN, OF THE WESTERN TELEPHONE CONSTRUCTION COMPANY.

Mr. J. E. Keelyn, of Chicago, gives evidence of his abiding faith in a page announcement in this issue. In addition he sends us a message, emphatically criticising the Bell company, in which he says:

The Berliner patent has stood for the past three years as a barrier against extensive investment in the practice of the art of telephony, notwithstanding that its legal qualifications are known to be of insignificant vital effect. Every one knows how sensitive capital is toward investment in enterprises having no standing; more so in an enterprise which has been clouded and curtailed by monopoly until it is looked upon somewhat in the nature of a mystery. The independent telephone movement is going forward grandly and with increased stability. At least 95 per cent of the independent telephone exchanges have absolutely proven profit. Those who have invested in one place are now seeking increased investments in others.

The public need not conclude that the action of the Supreme Court in this government case is so far-reaching that microphone transmitters may be monopolized by the Bell Telephone Company. There are a great many defenses to the Berliner patent not raised in the government case. In fact, evidence is at hand which will absolutely show the patent to be worthless, and, it may be added, that no intimation of this evidence appears yet to have discovered itself outside of the channels controlled by the Western Telephone Construction Company. The writer desires to assure the public that, in case of suit upon the Berliner patent against the Western Telephone Construction Company or its patrons, the Berliner patent will be defeated without question.

FROM THE STANDARD COMPANY.

SPECIAL DISPATCH TO ELECTRICAL REVIEW:

Decision means only that the Berliner patent was not fraudulently issued. It has been anticipated by foreign patents, and on this and other grounds will finally be signally defeated. We court a suit for infringement and stand ready to defend such, either against us or the users of our apparatus.

STANDARD TELEPHONE AND ELECTRIC COMPANY.
Madison, Wis., May 10.

FROM THE MISSOURI TELEPHONE COMPANY.

SPECIAL DISPATCH TO ELECTRICAL REVIEW.

The Berliner decision merely proves the Bell company is not a fraud; does not decide anything with reference to the validity of patents used by independent telephone companies.

MISSOURI TELEPHONE MANUFACTURING COMPANY.
St. Louis, May 10.

THE BONTA PATENTS.

SPECIAL TO ELECTRICAL REVIEW:

The decision leaves but two available transmitters in use: The Berliner, owned by the Bell company, and the M. & B., owned by the Make & Brake Telephone Company. All independent telephone companies who desire to protect themselves against litigation will be compelled to operate under the Make & Break patents.

MAKE & BREAK TELEPHONE COMPANY.
Philadelphia, May 10.

FROM THE BELL OFFICIALS.

There was no response to telegrams sent by the ELECTRICAL REVIEW to Boston, the headquarters of the American Bell Telephone Company. From conversation over the telephone, it was evident that they all were happy, and why not? They have received a clean bill of health and are now the undisputed owners of a valuable patent, properly and legally issued.

THE BELL COMPANY AND ITS OPPONENTS.

The American Bell Telephone Company is one of the most successful and ably managed corporations of the day. Starting with small capital shortly after the Bell patents were granted in 1876-7, it has kept pace with the marvelous growth of the telephone business, until now it is estimated that, including the capital of its sub-companies, over $100,000,000 are invested.

In its patent litigation it has uniformly been successful in the court of final resort, and the decision in the Berliner case completes a record for its president, Mr. John E. Hudson, its late attorney, Mr. J. J. Storrow, and their associates, unsurpassed in the history of the legal and corporation annals of the country.

THE OPPOSITION.

As to the opposition telephone companies, organized in the short time since the expiration of the Alexander Graham Bell patents, there has been invested in independent telephone exchanges and manufacturing companies from $3,000,000 to $5,000,000 in cash. Over 100,000 exchange sets are in use, mainly in the middle West and South. This does not include the vast number of private line instruments in factories, hotels, etc., that have been installed. In this latter field the independent companies have had a decided advantage over the Bell companies in being able to sell the instruments outright instead of exacting an annual rental, as has been the invariable rule of the American Bell Telephone Company through its licensees. Nevertheless, the business of these licensee companies in providing private line instruments and factory exchanges has greatly increased during the telephone agitation resulting from the expiration of the earlier Bell patents. On all sides comes a demand for the telephone, probably the most useful of any of the inventions of the century.

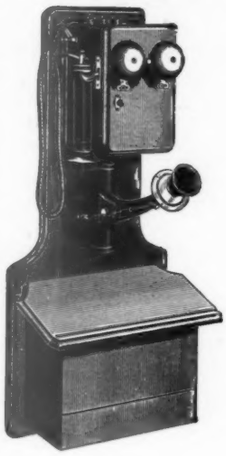
THE TELEGRAPH COMPANIES.

The question is often discussed whether the two telegraph organizations will not enter the telephone field. It is logical that they should, yet there is apparent harmony at the present time between the American Bell Telephone Company, the Western Union Telegraph Company and the Postal Telegraph Company. Just how long this will continue the future will disclose.

TELEPHONES

— FOR —

Exchange, Factory and Private Lines.



We have been in the telephone business for the past six years, and no decision of the Supreme Court, or any other court, can affect our business, because we do not infringe. You will always find us at the old stand. We want your orders, and will give them prompt attention.

DE VEAU & CO.,

No. 32 and 34 Frankfort Street, NEW YORK CITY.

OKONITE
TRADE MARK.

The Standard for Rubber Insulation.

OKONITE WIRES AND CABLES

FOR TELEPHONE SERVICE.

OKONITE TAPE. MANSON TAPE.

Candee Weatherproof Wire for Street Railway and Electric Light Use.

THE OKONITE COMPANY, Ltd.

WILLARD L. CANDEE, H. DURANT CHEEVER, } Managers.
GEORGE T. MANSON, General Supt.
W. H. HODGINS, Secretary.

253 Broadway,
NEW YORK.

OKONITE
TRADE MARK.

STILL IN THE FIELD. Supreme Court has refused to declare the Berliner patent invalid on the grounds on which the suit was brought.

The government has lost its case against the American Bell Telephone Company, the court holding that no fraud was exercised in obtaining the patent. This, however, leaves the question of validity open, and one to be fought out in the future.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY has always maintained that if the Supreme Court refused to declare the Berliner patent invalid, it would leave the patent in a position easily assailable on other grounds than those considered before the court. This company has guaranteed to maintain, at its own expense, all suits brought against the purchasers of its apparatus alleging infringement by such apparatus, and to pay all damages resulting from such suits. It has been fearless in its policy. It has always lived up to this guarantee, and proposes to continue doing so. It has the money, talent, and facts to back it, and ITS GUARANTEE TO-DAY IS AS GOOD AS ITS BOND.

It will continue to manufacture Microphones, and to protect the purchasers of these Microphones. This is not in defiance of the laws of this country; such a course would be foolhardy, but this company again asserts, as it has done many times before, that it has information in its possession which WILL DEFEAT THE BERLINER PATENT, if this company, or any of its customers, are sued for infringing it. This is the only company which has had the courage to fight the Bell Company to a finish on patent questions. It has come out victorious in every case, and feels sure of its present position.

THE WESTERN TELEPHONE CONSTRUCTION COMPANY'S claims of non-infringement of patents are always based on sound principles. Its promise of protection is absolutely reliable. Its past record proves this; its future course will strengthen it.

WESTERN TELEPHONE CONSTRUCTION CO.,

250 South Clinton Street, CHICAGO, ILL.

Largest Manufacturers of Switchboards and Telephone Apparatus Exclusively in the United States.

THE LAST HORSE CAR OF CHICAGO.

SOON TO BE SUPERSEDED BY THE TROLLEY.

The transformation of the Jefferson street line to a modern electric road, as is contemplated by the West Chicago Street Railway Company, will banish the last venerable relic of the oldest south-going horse-car line of the west side company, says a writer in the Chicago *Daily News:*

This line runs from Fifteenth street along Jefferson to Twelfth street, over Twelfth to Canal, and thence to Madison, stopping at Fifth avenue. The road was built years ago, when there wasn't much beyond its terminus but prairie and atmosphere. For a long time it did a flourishing business. The city grew, business kept pushing out, and the harvest of nickels waxed bountiful. But along with the growth of the city came new street-car lines; then came the cable, and finally electricity. All these entered into competition with the old Jefferson street line, and its patronage began to dwindle, until to-day its rolling stock has shrunk to one rickety car and two rickety horses.

The car has a despondent leaning toward one side of the street, and the horses trot along with a slow, solemn, tow-path swagger. This outfit is manned by a conductor with a hungry-looking mustache, and a driver that looks like Santa Claus. Rumor has it that he and the horses were on the first car that went over the road.

Every week-day this aggregation plies between the city and Fifteenth street unnoticed by even the drivers who get on the track in front of it. Sometimes a passenger is picked up and sometimes the whole trip is made without so much as a street gamin jumping on the car to steal a ride. Once a man and his wife and 10 children boarded the car at Canal and Twelfth streets and rode downtown, and tradition has it that when the clerk in the railway offices looked at the register at night he fell off his stool and was not revived for half an hour.

The car runs on schedule when everything goes well, but that isn't very often. There are always coal wagons to cause delays, and for some reason or other the car finds it necessary to take a new route downtown ever so often, and sometimes instead of being at Madison and Fifth avenues it will bring up at Van Buren and State streets, or will go ambling around the Blue Island avenue cable loop serenely and leisurely, in spite of the clanging of the gongs of half a dozen grip cars that are trailing after it.

Out near the terminus of the line a business man has a factory, and he is one of the few people in Chicago who know anything about the Jefferson street horse-car line. Occasionally, when he happened to be going downtown, he takes it, because it is the only closed street-car in the city where a man is allowed to sit under one of Mr. Kerr's blue signs and smoke to his heart's content. But on this line, as the smoker is almost invariably the only passenger, he is allowed all the rights and privileges of the man who freezes his face to ride on the grip. Sometimes this business man is delayed, but when he finds he will not be able to start until 10 or 15 minutes after the car is scheduled to leave, he simply sends a boy down to tell the conductor and the train is held. But ordinarily the car has little to do with passengers, its business being the holding of the franchise.

Aside from the peculiarities already mentioned there are two other features about this veteran, and they are that it does not run on Sunday and that it is heated in the Winter.

Development of Niagara Falls Power on the Canadian Side.

A great deal of interest is being taken in the local power district at Niagara Falls, N. Y., in the Canadian Niagara Power Company's commencement of their power development on the other side of the river. The Canadian company was organized on April 12, 1892, by special act of the Parliament of Ontario, to develop power within Queen Victoria Park, the work to be begun May 1, 1897, and to be completed November 1, 1898. Water connections for 25,000 horse-power are to be completed on that date, and 10,000 developed horse-power are to be ready for delivery.

Messrs. A. D. Shaw, F. L. Stetson and W. B. Rankine and their assigns were the gentlemen who obtained this important privilege. On account of the lack of *bona fide* applications for power to be used locally, and the difficulty in procuring American machinery, an application was made a year ago for an extension of time for 18 months. This application has been strongly opposed by interested parties on the other side, and was finally disapproved on April 23 last. The Canadian company commenced work at once, and on April 30 ground was broken on the site of the new power house. A. C. Douglas, the contractor who sank the first wheel-pit of the Niagara Falls Power Company, has charge of the new work, and has a number of laborers engaged in excavating.

One of the proposed plans contemplates the erection of two power houses, each having a capacity of 125,000 horse-power, fed by separate canals and discharging by tunnels 800 and 300 feet long, respectively, into the lower river. For the present, however, only a small part of this power will be developed, as the local demand will be small. It is expected that a great part of the output of this company in the future will be delivered in Buffalo, N. Y., and Toronto and Hamilton, Ont.

The E. S. Greeley & Company.

Rumors were afloat in New York city last Saturday that one cause for the recent failure of the E. S. Greeley & Company, was a large defalcation extending over a period of several years. The receivers of the company, Gen. E. S. Greeley, former president, and Mr. James W. Sands, former secretary of the company, would, it was said, include an account of the matter in their report to the court. Neither General Greeley nor Mr. Sands were in New York city on Monday of this week.

New York Electrical Society.

At the annual meeting of the New York Electrical Society, which will take place at Columbia University on Thursday, May 20, some entirely novel features in the development of the thermopile will be demonstrated, with practical illustrations, by Mr. H. Barringer Cox.

Electrical Engineers in South Africa.

A report on the electrical and allied trades at the Cape is being prepared by Mr. A. P. Trotter, in his capacity as honorary correspondent of the London Chamber of Commerce for Cape Colony, and he will allude in the report, among other matters, to the prospects of employment for electrical engineers in South Africa, says a London exchange. In the course of a letter to the London Chamber, dated Cape Town, March 24, Mr. Trotter says: "My object in writing now is to ask you to make it known as widely as possible, through your journal and through the technical press, that no electrical engineers should come out to South Africa at present, unless they have secured definite appointments before sailing. Electrical engineers, experienced and (apparently) otherwise, come to me almost as regularly as the mail, with and without introductions. I regret that I have not been able to give any assistance whatever. Engineers wanting assistants generally send home for them—a very satisfactory course for both parties. I have received letters from electrical engineers of some experience in the Transvaal, that, owing to the stagnation of trade, staffs are being reduced, and that many competent men are out of employment."

Cheap Light for Des Moines, Iowa.

The Board of Public Works, of Des Moines, Iowa, after a thorough consideration of the several bids on a municipal lighting plant, last week, through its electric light committee, concluded to recommend to the council the proposal of the McCaskey & Holcomb company, of Springfield, Ill., on a combined tower and low-light system. The company's bid is considered by some phenomenal, as under its terms the city becomes the owner of the plant in about six years, by paying at the rate of $4,583.33⅓ per month. The company submitted bids for a 350-light tower system and for a 500-light, low-light system, the figure on the tower system being $123,360, while the low-light system will cost $113,360. The bid of the McCaskey & Holcomb company was the only one covering a complete plant, and thereby conforming to the terms of the advertisement. The city of Des Moines is paying at present for about 300 lights, at the rate of $96 for the moonlight schedule and $126 for the all-night lights.

Exhibits at the Convention of the National Electric Light Association.

To the Editor of Electrical Review:

A great many inquiries are being received at this office regarding exhibits at the coming Niagara convention. For the benefit of those desiring to make an exhibit, we will state that no exhibition will be held under the auspices of the association, but, from the tenor of our correspondence and personal interviews, we learn that many exhibitions will be made by our associate members in the parlors and rooms at the hotel.

Yours very truly,
GEO. F. PORTER,
Secretary.

New York, May 8.

A Vigorous Reply From Mr. Keelyn.

To the Editor of Electrical Review:

An article appears in the *Electrical Engineering* (a Bell organ), under the head: "Scheming for Other People's Money," signed by Fred de Land, which I wish to state is absolutely false, cowardly and malicious.

The writer's conduct in honestly and vigorously opposing the Bell telephone monopoly is evidently subjecting him to these underhanded and scurrilous attacks. It is in line with the oppressive policy of the Bell people and some of their contemptible hirelings.

The insinuations and slurs cast against the Western Telephone Construction Company and myself are probably inspired by a discharged official of this company, as their own venom stamp them as the effusion of a disgruntled and baffled person. It is needless to say that they are without the least foundation, in fact, whatever. We have the whole telephone world (excluding the monopoly) to back our claims for absolute upright and honorable dealings, and the reputation of this company for prompt payments is too solid to be shaken by such poisonous attacks.

It is beneath my dignity to enter into detailed or lengthy controversies of any kind with one whose evident standard of principle is on so low a plane. Very truly,

J. E. KEELYN.

Chicago, May 1.

Stacey-Parker.

The marriage of Mr. Thomas I. Stacey, secretary and treasurer of the Electric Appliance Company, Chicago, to Miss Lillie Parker, of Evanston, solemnized at St. Mark's Episcopal Church, Evanston, Ill., at 7.30 P. M., on May 5, came as a pleasant surprise to the many friends of the groom, who with his accomplished bride was many miles away from the scene of the evening's brilliant festivities before the electrical fraternity, at least, had an inkling that Mr. Stacey had concluded to turn benedict. After a few weeks wedding journey, the itinerary of which is known to the happy couple only, they will return and take up their residence in Evanston. It is needless perhaps to state that, in the new home, electric appliances of the latest improved type will play an important part in adding to the comforts of life. The ELECTRICAL REVIEW extends its heartiest congratulations and well wishes.

Interior Conduit and Insulation Company.

Justice Russell, in the New York Supreme Court, has granted an injunction to the minority stockholders enjoining the Interior Conduit and Insulation Company, of New York city, from issuing $500,000 debenture bonds and reducing the capital stock to $1,000,000. A plan to increase the capital stock will also be defeated by the injunction.

A Successful Telephone Company.

The Erie Telegraph and Telephone Company, in its two-page announcement in this issue, presents a record of successful achievement that is highly creditable to its progressive management. Telephone men will read it with much interest.

FINANCIAL PRACTICE AND ENGINEERING METHODS OF AMERICAN STREET RAILWAYS.

DELIVERED BEFORE THE NEW YORK ELECTRICAL SOCIETY, AT COLUMBIA COLLEGE, APRIL 7, 1897, BY E. E. HIGGINS.

(Concluded from page 208.)

The distribution circuit is always an interesting part of a street railway plant. There has not been any material difference in the practice of adopting a parallel system of distribution, at a pressure of 500 volts. Experiments with less voltage were early given up. The series system has much to commend it theoretically, but has not proved a success, and has very great difficulties in the way of success on any large system. The alternating system which we hope will come along, we will find will solve many problems that are now troubling us. One principal item is the solution of the copper problem. It is not a pleasant thing to put a whole copper mine in a city, and there is a chance for great improvement, I think, in that item, and possibly still more in the direction of doing away with the commutators of the motors, and all the commutator difficulties which, as we know, are a large proportion of the motor difficulties in toto. The three-wire system has been thought of in connection with street railroad work, and experiments have been made with it, but it has not been considered feasible for various reasons, among them the difficulty of crossing wires at branches with 500 volts difference of potential between them. This is a serious, and in some cases a prohibitory, matter. The feeder systems of the distribution system are a heavy burden on the road, and constantly growing heavier with the increase of the number of cars called for by population increase and extensions. It is customary to divide the overhead circuit into a larger or smaller number of sections, and to have the feeders run to the station from those sections. Originally there was a little different arrangement of feeders by which the sections of the trolley wire were made smaller and tapped into the same feed wire, with fuses or some automatic cut-out arrangement, so that if a section 1,000 feet in length gave out, it would disconnect the section from the continuous feeder, but would not blow any cut-out at the station. It has the disadvantage of evolving trouble on the line; you have to get a repair wagon out there as quickly as possible to locate the trouble and put in a fuse. There may be no difficulty whatever on the line. It may simply be aground from the motor, but the fuse has to be installed. That has been almost entirely discarded in this country, but I see by board of trade regulations in foreign countries it is now used quite generally, but I think they will soon discover that changes are necessary.

Various methods of doing away with this waste of copper have been devised; among them the "booster" system. This is a very ingenious and pretty system. Its operation is very generally known, and it will hardly be necessary for me to describe it here. I think nothing need be said about the overhead construction, except that in general it is very good. Iron poles are used almost universally now in our principal cities, and can be made ornamental, and will last longer probably than wooden poles will, although we have no actual knowledge on that point from experience. The span wire construction is light and strong. Altogether we seem to have gone pretty nearly as far as we can go in perfecting the overhead construction. There is a possibility of doing away with frogs and switches, and quite a little of the special work in that way, by the adoption of a trolley other than the wheel trolley. At present such trolleys are in quite general use abroad, and, to some extent, in this country. There is also another means of doing away with some of the disadvantages on a single track, and that is by running two trolley wires along the track, branching out at turnouts, so as to make it unnecessary for the trolley to leave the wire at any time. The copper for two trolley wires is necessary on the line, and there is no reason why it should not be an excellent form of construction. The return circuit has always been a source of weakness in the electric railroads. Originally galvanized bonds were put in, but were replaced with copper bonds. There has been always more or less corrosive or electrolytic action between the iron of the rail and the bonds, and the bonds have given considerable trouble in their way. They have been recently improved very materially, and now are perhaps of equal efficiency with overhead appliances, but are by no means perfect, and are likely to give trouble. It is probable that the return circuit in most cases can not be made by bonds alone, but some form of supplementary return wire is necessary. The original form was to put supplementary wires in the center of the track and connect them with the different rails, but the practice now appears to be to establish certain centers of current collection, as it were, from which centers the return electricity would be drawn off to the stations through return feeders carried on poles, or in some cases under ground, where the earth is of a suitable nature. I think in large systems these return feeders are necessary and should be adopted, and there should be great care taken in making frequent tests to determine the difference of electro-motive force between the rail and water and gas pipes which are underneath the rail. The electrolytic action on the gas and water pipes is a serious matter, but it can be cured. The cure lies, broadly speaking, in the destruction of any difference of electro-motive force between the rails and the pipes. The instant you have that difference of electro-motive force—difference of potential—you have a flow of current, and that flow of current will eat up the pipes. The methods of preventing that electro-motive force from arising are pretty well known, and consist in localizing it in various places. The area near the power stations is the most dangerous, and that remote from the power station gives very little trouble. If you provide a perfect bond connection of your rails as nearly perfect as you can get it, and bond the rails and the water pipes together, where this condition is slight (and where the condition is greatest you have there the localities of greatest current density, as it were, and there you must draw off the current through the supplementary return feeders), the slight flow of current will do very little, if any, harm.

Underground conduit roads are often urged as a cure for the evils of the overhead system. They certainly are a cure in many respects. None of us like the overhead wires, and we would all be glad to get rid of them. The difficulties in the way are obvious, chiefly in the matter of the initial cost, and, consequently, of the return on the investment. The open conduit, as being put in in this city, is probably as inexpensive as any open conduit can be. It is made quite shallow, much more so than cable conduits; it is built from the top down, and not from the bottom up, so that it is not necessary to provide the foundations, which are usually in the old construction, and the conduit is apparently worked with entire success and economy, the initial cost being the principal item against it. There has been a good deal of talk about closed conduits, and it is certainly true that closed conduits are theoretically very pretty devices, and, if we could put aside certain practical disadvantages, we would have something satisfactory. The main disadvantages are these—the service of 500 or 1,000 pieces of mechanism per mile of track; that is the principal thing. You have the magnets, armatures and contact points, and to have 500 or 1,000 figures of them for every mile of double track, or, say, even a less number of them, is to make it almost certain that, sooner or later, and probably very frequently, some one, or a number of them, are going to get out of order and give trouble and block the line. There is one thing that the street railway manager is certain about—his line must not be blocked under any circumstances. Every effort is made to prevent it. Another serious disadvantage of the closed conduit lies in the liability to sweating inside the tube and condensation of moisture; it is impossible to keep air out and impossible to make perfect joints where the contacts come, and I am inclined to think that, as a matter of fact, the closed conduits would give trouble from moisture inside in one form or another. One thing I have omitted which may possibly be of interest in the question of power houses. I have examined the figures of 69 roads in New York and Massachusetts for 1896, as to the cost of electro-motive force. The cost in Massachusetts includes the repairs and renewals of power house apparatus, but this is not included in New York State. Of the 69 roads there are only four which are operated at less than one cent per car mile; 12, at from one to one and one-half; 16, one and one-half to two; 30, two to three; nine, three to four, and six, four to five. It is true, as these figures show, that in the larger cities the cost of operation is actually smaller, but there are exceptions in all these cases.

The matter of roadbed is one of which I shall say very little. The standard construction to-day is with deep girder rails, nine inches where paving blocks are used, and seven and eight inches where other forms of pavement are used, or where pavement blocks are of a size to permit the use of the present construction, with joints of sufficient length, we hope, is going to be good. As a matter of fact, however, I think that the difficulty with these deep girder joints is going to be found at the joints, and less in the pounding of the joints themselves than in the flattening out, and of the formation of hollows, due to the rails having insufficient carbon. I am not an expert on the subject of rail manufacture, but this thing is certainly true, that steam railroads are getting higher percentages of carbon than they ever used before, and are consequently getting more brittle rails, but rails which will withstand wear better. It is also true that we can go still higher in carbon in street railroad rails than the steam railroads can, as far as the liability to accident is concerned, which is one of the limiting features in steam railroading. Steam railroads can not afford to have a rail break; it means usually an expensive accident—a tremendous, expensive accident, if it is a passenger train. Electric railroads have no such limitations. There is no serious liability to an accident on account of a broken rail. The rails are imbedded in the pavement, and can not move upward or sidewise to any material extent. I believe firmly that street railroad managers ought to investigate very carefully the results obtained with rails of different percentages of carbon, and take into account, in general, all the features of rail composition, so as to get a strong, tough, hard rail, and to get something that will not mash from softness, as many of the rails are doing. There are any number of different kinds of joints. The ordinary channel-plate joint has been found to be too weak, if less than 30 inches in length, and 36 inches and even higher lengths are put in frequently by conservative roads. Cast welding and electric welding are in use to some extent, electric welding being limited by the capacity of the plant very largely. Cast welding is the hope of a great many roads, not only in new construction, but in bringing up the joints of old construction. We do not know enough about it yet to predict what the results will be. There are many patent joints, some of which are good, and some are worthless.

The special work is always an important feature of track construction—an extremely expensive feature—and ought to be laid out with great care to have the rails and grooves fit the wheels; that is to say, the wheels and the track in general, and the special work in particular, ought to be determined upon in view of their mutual relations. It is something which is not done in any adequate way or to any adequate extent, and the street railway companies are discovering this to their cost, and will continue to do so if they do not make a radical change. Where wheels grind out special work or special work breaks wheels, something is wrong.

The rolling stock of America is, I suppose, better than that of any country in the world, and it is really well constructed—cars lighter, more elegant, lines laid out with the idea of getting greater strength with the least weight, and, as far as the seating capacity is concerned, it is difficult to see any improvement from the point of view of the public. Some of the long double-truck cars are as comfortable and easy to ride in as can be desired. The trucks are the interesting portion of the rolling stock, and there are, of course, a large variety of them. The style of the old horse railway truck, which was followed for a short time with electricity, was to fasten the car bodies directly to the box of the axles, and to do away entirely with connections with the axles, except by the car bodies. The independent motor truck was then developed, and is in exclusive use to-day. With single-truck cars, one of the grave difficulties is the oscillation of the car body, particularly when speeds are considerable; and this oscillation is prevented in most cases by the extension of the spring base to a considerable portion of the entire car length. Sometimes, however, unless the spring is carefully graduated, there are difficulties introduced in the peculiar jarring motion of the car which are disagreeable to the passengers, and great care is to be taken in the manufacture of trucks to avoid this. Hand-brakes, air-brakes, electric brakes, mechanical brakes, all have their place, and all are being experimented with with a good deal of care to determine some means of keeping

down the accident account. It is hard to tell what the result will be. There is much to be said in favor of them all, and we all hope that the very distressing accidents which occur at times will in some way be prevented by them, both because of the street railway companies and on the score of general humanity. The electric equipment of a car has reached a point now where the economic use of power is extremely good.

I thank you very much for your kind attention. (Applause.)

The president put Mr. Perry's motion, which was carried, after which the meeting adjourned.

LITERARY.

We have received from the authors a reprint from the *Philosophical Magazine* of a paper entitled "Discussion of the Currents in the Branches of a Wheatstone's Bridge, where each branch contains Resistance and Inductance, and there is an harmonic impressed electro-motive force," by Albert Cushing Crehore, Ph. D., assistant professor of physics, Dartmouth College, and George Owen Squier, Ph. D., first lieutenant, United States Army.

We are in receipt of the first number, that for April, of an attractive magazine called *Accountics*. It is published by the Accountics Association, 88 Wall street, New York city, at $1 per year, and is devoted to advancing the science of accounting and to secure a proper recognition of it as an element of business. The leading article, entitled "The Vital Element of Business", is a masterly one, by Charles Dutton, F. I. A., whose portrait forms the frontispiece of the magazine.

A beautiful cover in nine colors, from a design by Gorguet, the distinguished French artist, gives promise of the bright and Spring-like contents of the May number of *Scribner's Magazine*. It launches a new kind of college article—not a history of the institution, but a reminiscent and discursive account of "Undergraduate Life", old and new, which is always the college in the minds of its graduates. Edward S. Martin, one of the founders of the *Lampoon* and a graduate of '77, opens the series with Harvard.

"Rail Bonding and the Protective Rail" is the title of an attractive little leather-bound volume just issued by the Forest City Electric Company, of Cleveland, Ohio, who are the manufacturers of the "protective" rail bond. The volume is excellently illustrated with diagrams showing comparative methods of rail bonding and half-tone illustrations, showing the results of electrolysis and oxidation in connection with the subject of rail bonds. This has become a very important element in street railroad construction, and it is apparent in this little book that the subject has been given the closest study by the Forest City Electric Company.

"WIRING TABLES AND HOW TO USE THEM." By Thos. S. Grier. Eighty pp., 5 by 7½ inches, price, $1. Sent, post free, on receipt of price by ELECTRICAL REVIEW Publishing Company, 41 Park Row, New York city.

The development of the electric light and power industry has brought with it, from year to year, some wiring table, wiring chart or wiring rule, intended to afford those engaged in the art a quick, convenient and, presumably, accurate means of determining the proper sizes of conductors for distributing current from one point to another. By the engineer who has had the advantages of special education in this branch, the average wiring table would probably be considered as too cumbersome, the slide rule giving the desired result much quicker, but to the average wireman or electrical worker, a reliable wiring table will always be not only a convenience, but often a necessity. The book recently issued by Thos. G. Grier not only gives all the various tables to meet the usual demands in practical wiring, but also shows how such tables are compiled, and gives the reasons for the methods used. It contains in "understandable" language the laws of resistance, electro-motive force and current. It tells how to calculate the size of wires, and gives the different methods of wiring, with diagrams. In short, there is hardly a question on wiring to which an answer can not be found in Mr. Grier's new book.

Resolutions on the Death of J. M. Orford.

At a meeting last week of the Electric Potential, of Boston, formal resolutions on the recent death of Mr. John M. Orford were presented by a committee composed of Capt. Wm. Brophy, chairman; Geo. B. Neal and Chas. B. Davis. An abstract of the resolutions follows:

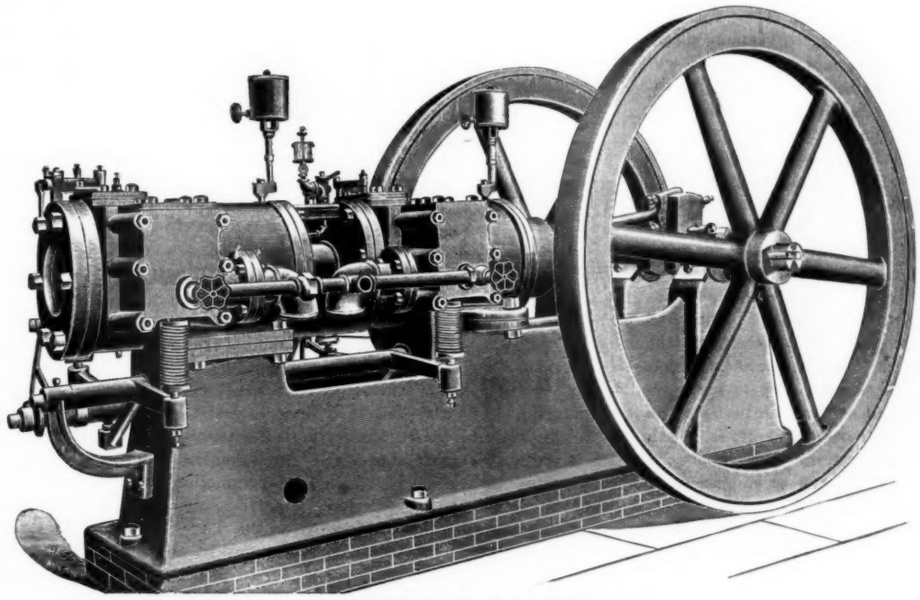
Resolved: That we recognize and appreciate the good and sturdy character of our departed fellow member; his untiring and whole-hearted devotion to duty; geniality and character that has endeared him to all who knew him; his energy, ability and vigilance in the discharge of the exacting and important duties in the many important positions he has been called upon to fill during a busy and useful life; the wholesome and powerful influence of his ever-kindly disposition and conduct; his untarnished reputation as a citizen, companion and friend, and the credit reflected upon the electrical profession by his long and faithful service in his and our chosen calling.

The Hicks Gas Engine.

The Hicks gas engine, illustrated herewith, shows a radical departure from the usual method of building gas engines constructed with two cylinders. Every outstroke of the piston delivers power to the shaft, so that the engine is doubly as powerful as one in which every other outstroke is a power stroke. The power of the piston tends to force the shaft upon the solid parts of its bearings, and so relieves the cap entirely of wear. If the cap were removed, the engine would still run, consequently there is no pounding of the shaft in any of the bearings. The valves admitting the compound to the clyinders are direct-acting vertical poppet valves.

The smaller sizes of this engine are started by hand, the operation being as follows: The gas throttle valve being opened, turn the flywheel by hand once or twice and the engine will start in full operation. At the first outward movement of the piston, the explosive compound will be drawn into one of the cylinders, say the end one, through the valves, which then close and prevent its flowing back into the pipe as the pistons make their back stroke. While the compound in the end cylinder is being compressed in the end of the cylinder, the crank shaft passes its in-center, the charge in the end cylinder is exploded by electric spark, and the expanding air and gases drive the piston out rapidly and start the engine. When the piston has completed its outward movement and starts back, the escape valve is opened and the burnt gases in the cylinder allowed to escape. On its next outward movement, the piston again draws in a fresh charge of the compound, which is compressed and exploded as before. When the pistons are on the outward stroke under the impulse of the explosion in the end cylinder, the front cylinder is drawing in its charge of the compound to be compressed and exploded, while the end cylinder is being cleared of the burnt gases and recharged, the two cylinders thus working alternately, thus getting an impulse at every turn of crank, if load on engine requires it.

In view of the fact that this engine receives an impulse at every turn of the crank, it is claimed by the manufacturers as being particularly adapted for isolated electric lighting purposes, as the impulses being at every revolution are less violent, thus permitting steadier light. The general eastern agent for these engines is the Yaryan company, 142 Times Building, New York.



THE IMPROVED HICKS GAS ENGINE.

Mr. Hale's Reply to a Question on Cables.

TO THE EDITOR OF ELECTRICAL REVIEW:

As regards the question of Mr. Stevenson, in your issue of April 14, concerning the variation in the dielectric resistance between the temperatures 60 and 74 degrees Fahrenheit, in a lead-sheathed, paper insulated cable, saturated with resin oil, we will state as follows: The curve was constructed with great care from measurements made on several Western Electric Company's cables of the above description, and while admitting the inability to accurately determine the temperature of the interior of the cable, we still maintain that the general form of the curve is correct.

To obtain more data on this point, measurements on similar cables have been made since reading your criticism, and the following results have been secured. It was found that with a slight trace of moisture in the cable the insulation resistance did not become high, notwithstanding a temperature of 58 degrees, and of course no rapid change was noticed. However, in cables which have a fairly high dielectric resistance at 75 degrees, a rapid rise to a very high value was noted, with a drop in temperature to 58 degrees, which values varied nearly in accordance with the curve as given. Very truly,

GEO. D. HALE.

Western Electric Company,
April 29.

A ROENTGEN-RAY TUBE WITH AUTOMATICALLY ADJUSTABLE VACUUM.

ABSTRACT OF A PAPER READ BEFORE THE ELECTRICAL SECTION OF THE FRANKLIN INSTITUTE, PHILADELPHIA, APRIL 27, 1897, BY H. LYMAN SAYEN.

The most important and yet the most imperfect piece of apparatus that is necessary for the production of X rays is the Crookes tube. It consists fundamentally of a cathode capable of focusing a stream of "radiant matter" upon a platinum plate, the whole being inclosed in a properly exhausted vessel.

Since the announcement of the focus tube in March, 1896, there have been few changes in the material arrangement of these parts. Many attempts, however, have been made to remedy one great defect which is inherent to Crookes tubes, and that is the gradual rise in vacuum subsequent to their constant use. I will briefly describe some of these methods and endeavor to show why they are inefficient.

Many makers provide their tubes with a little bulb opening into the main tube and containing potassium hydrate or other material which is capable of giving off gas on being heated. When the vacuum gets too high a spirit lamp is placed under the bulb, and a small quantity of vapor is given off, which lowers the vacuum the desired amount. It has further been suggested to use a resistance coil around the bulb and to regulate the heat by means of an auxiliary source of current.

Another scheme, as suggested by Dr. William Morton, of New York, is to seal a small incandescent lamp on the main bulb, the two bulbs opening into each other, and to bring down the vacuum by passing an auxiliary current through the lamp filament.

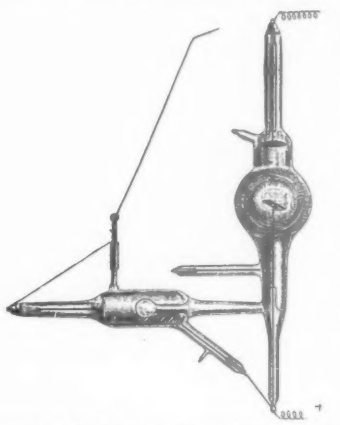
Siemens & Halske, of Berlin, have recently put on the market a Roentgen-ray tube, in which the vacuum is adjusted in a most ingenious manner. A small bulb, containing an internal electrode to which external connection can be made, is connected to the main tube. This bulb contains phosphoric vapors, which have the property of condensing when traversed by an electric current. To raise the vacuum the electrode of the bulb and the cathode are connected to the induction coil. Warming the bulb causes the phosphorous to revaporize and lower the vacuum.

In all these schemes the vacuum may be varied over wide limits, and the life of the tube is increased to an indefinite extent; but, as they all depend on the skillful manipulation of the operator, it is seldom that they accomplish the desired result. The vacuum in a Roentgen-ray tube can only vary over very small limits, and, being also dependent on the temperature of the tube, it is in a very unstable position; that is, if a tube starts to heat when running, the vacuum lowers and the tube takes more current, due to the increased conductivity of the gas therein, lowering the vacuum still more, while a reverse condition of affairs takes place if the tube cools. So it will be seen that it is very difficult and often impossible to keep the temperature of the tube and to manage the regulating device to produce the desired result. One way of using these devices is to lower the vacuum the desired amount, and to keep it low by running with the platinum hot enough to keep the vacuum down.

The ideal regulating device should possess the following qualities:

1. It should act immediately.
2. It should be independent of the temperature of the tube.
3. It should keep the desired vacuum.

Having in mind the difficulties mentioned and the qualities desired, Messrs. Queen & Company authorized



QUEEN & COMPANY'S ADJUSTABLE X-RAY TUBE.

me to proceed in their laboratory with a series of experiments, which have resulted in the device which I will now describe.

A reference to the illustration will make the operation of this device clear. A small bulb, containing a chemical which gives off vapor on being heated and reabsorbs it when it cools, is directly connected to the main tube and surrounded by an auxiliary tube, which is exhausted to a low Crookes vacuum.

In the auxiliary tube the cathode is opposite to the above-mentioned bulb, so that any discharge through it will heat this bulb. This cathode is connected to an adjustable spark point, which may be placed at any desired distance from the cathode of the main tube. The main tube is exhausted to as high a degree as possible, in the first place, while running hot, and the chemical in the small bulb is rid of enough of its gas to insure its remaining high at all ordinary atmospheric temperatures.

In operating, the induction coil is connected as usual to the main bulb. On starting the coil, the vacuum of the main tube being high, the resistance is also high and the current takes the path of the least resistance through the auxiliary tube, thereby heating the chemical in the small bulb. This will continue for a few seconds, until a sufficient amount of vapor has been driven into the main tube to permit the current to go through it. After this only an occasional spark will jump across the spark-gap, to maintain the tube at the same vacuum. The vacuum may be set high or low by placing the spark-point a considerable distance from or close to the cathode of the main tube.

I have here before you, on the table, a tube of this pattern connected to a large induction coil specially constructed by Queen & Company for Roentgen-ray work. The coil gives a 14-inch spark and runs in a most quiet manner on the 110-volt circuit. By means of a resistance in the base I can regulate the current in the primary to any amount desired, up to the limit of the coil. This fluorescent screen, behind which I have placed a thick book, will show any difference of penetrability of the Roentgen rays due to difference of vacuum. On starting the current you see the main tube remains dark and the spark jumps across the spark-gap. Almost immediately the large tube lights up. It is now possible to increase the current, and you can see that it is possible to get the platinum anode brightly incandescent without lowering the vacuum in the least, as shown by the brilliant fluorescence on the screen. I shut off the current and bring the spark-points together. On starting the coil the main tube lights up at a very low vacuum; so low that there is no fluorescence produced at all.

The tube now has the characteristic appearance of running on an alternating current. The reason for this is that the resistance of the tube is so low that the secondary of the coil is practically short-circuited, and by its mutual induction decreases the self-induction in the primary, allowing the current to rise more quickly on the make, producing considerable current in the secondary in the reversed direction. This effect is not so noticeable on battery circuits, because the impressed electro-motive force is not so high on the make. I will not run much current through the tube at this point, because it blackens the bulb considerably, due to disintegrated platinum when the platinum becomes cathode.

If I put a short spark-gap in series with the tube and secondary, you will notice that the alternating effect disappears, and it is now perfectly safe to increase the current. I should advise all experimenters who desire to keep their tubes from blackening, that in using tubes where the platinum is the anode (and with the platinum anode we get undoubtedly better X rays), to use a similar spark-gap in this manner. The sparking distance should be greater than the coil will spark on the make, and it is especially desirable where it is necessary to run on low vacuum with 110-volt primary.

On separating the spark-points you see the vacuum rises slowly in the main tube until the spark prefers to jump across the gap. The tube now runs quite steadily without flicker, a small intermittent spark being sufficient to keep the vacuum down.

I will now connect the coil to the heating tube only and run it lightly for a few seconds, so as to drive considerable gas into the main tube. On connecting again to the main tube, it will be noticed that the vacuum is so low that the gas is simply a conducting stream between the terminals, such as we recognize in a tube exhausted to a couple of millimetres of mercury.

Supposing we assume, after Sir William Crookes, that the vacuum necessary to produce X-ray effects is about one-millionth of an atmosphere (this is a low enough assumption at any rate), this bulb then contains enough gas to fill this whole hall at that high vacuum, so that the life of such a tube, barring misuse, should be practically unlimited.

From even this most severe treatment the tube rapidly recovers, and is now working in its normal state.

I will conclude my paper this evening with a brief summary of the advantages which I think a tube of this kind possesses over the ordinary type.

1. Adjustable vacuum.

It may be set at any vacuum desired from one so high that no current will penetrate it, to one so low that the current would rather go through the tube than jump over a parallel spark-gap of one-half of an inch. In a radiograph of the hand, for instance, it is desirable to use a low vacuum to secure the necessary contrast between bone and flesh, while in locating foreign metallic bodies in dense tissue, it is desirable to use a high vacuum.

2. Automatic regulation.

At whatever vacuum it is set it will remain, so long as the coil is running without any attention whatever from the operator.

3. It will stand considerable energy without decrease of vacuum, consequently shortening the time of exposure necessary.

Prof. Arthur W. Goodspeed, of the University of Pennsylvania, has taken his best radiograph of the hip in three minutes with one of these tubes; he has also taken an excellent one in one minute. Dr. Wm. M. Sweet, with the tube adjusted at high vacuum, has located foreign bodies in the eye, the pictures being taken perpendicularly across the head with an exposure of 30 seconds.

4. A long lease of life.

About Lightning Rods.

TO THE EDITOR OF ELECTRICAL REVIEW:

I read in your issue of the 14th instant an answer to Mr. H. R. Butler's inquiry in regard to lightning rods. Could you, without too much trouble, give me the address of Maj. David Porter Heap, U. S. A., whose communication you reproduced in the above issue, concerning the proper construction for lightning protection? I should be greatly obliged for any information you can give concerning his present address.

EDWARD SLADE.

April 27.

[The present address of Lieut.-Col. D. P. Heap, U. S. A., is Tompkinsville, Staten Island, N. Y.—ED.]

Quaker City Dynamos and Motors.

Several substantial types of electrical machines are being made by the Quaker City Electric Company, Carter street, Philadelphia, which are thoroughly modern in construction and have many features worthy of consideration. The machine just perfected by them, shown in Fig. 1, is a direct-current, multipolar dynamo for lighting and power, aimed to accomplish the highest efficiency, smoothness of operation, and is capable of developing the rated output without overheating. Owing to the generous proportion of the commutator and the brush capacity, there is no sparking. The construction of the machine throughout is solid, substantial and compact, with low center of gravity, and the weight distributed over an ample bed-plate. The bearings are self-oiling, with large bronze-metal bushings and double oil rings in each journal. The magnet coils are machine wound on standard forms and slipped over pole pieces, allowing absolute interchangeability. The commutators are unusually large, affording ample surface for wear.

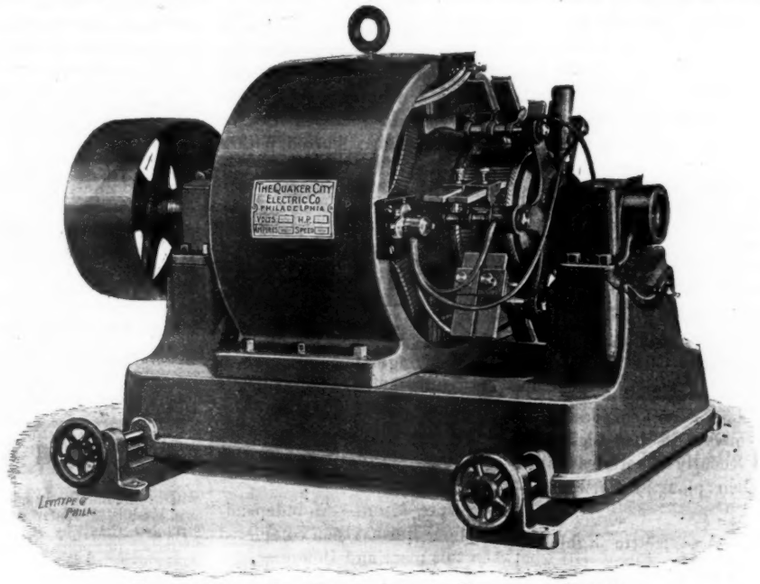


FIG. 1.—QUAKER CITY DIRECT-CURRENT MULTIPOLAR DYNAMO.

The direct-current, self-contained type of bipolar motor, shown in Fig. 2, is designed specially for service on cranes, direct or belt-driven machine tools, belt or direct-driven elevators, and work of a similar nature, where a reversible or series-controlled machine is required, and is also now in use in a number of small traction plants, and for small factory railroads in the yards and mines. The frame is a solid-steel casting, surrounding the magnets and armature, and the motor may be mounted on a small truck for a portable machine.

The standard types of machine, illustrated in Fig. 3, are built for moderate speed and are claimed to be free from all complications and particularly easily handled, as the generators are compound wound and automatic in regulation. The commutator is of the greatest radial depth, insulated under pressure and keyed to shaft, which is of large diameter. The frame, comprising the bed-plate, bearing pedestals and field-magnet cores, is one solid, soft-steel casting, without joints, insuring perfect alignment, absolute rigidity and a perfectly centered armature.

FIG. 2.—QUAKER CITY BIPOLAR MOTOR.

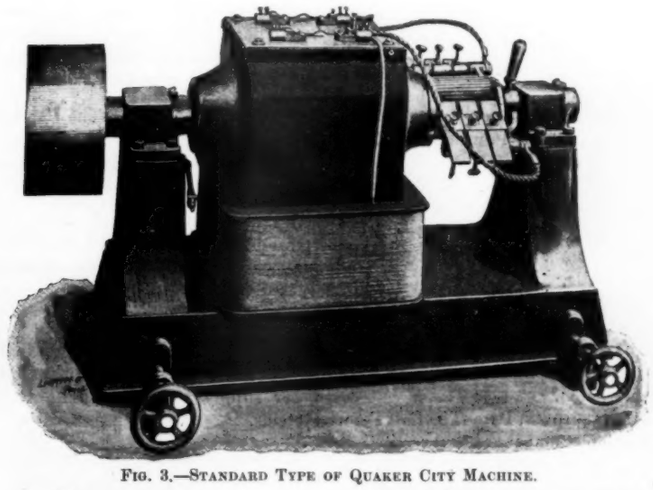


FIG. 3.—STANDARD TYPE OF QUAKER CITY MACHINE.

Advantages of Clean X-Ray Tubes.

TO THE EDITOR OF ELECTRICAL REVIEW:

Perhaps the following experience may interest your readers who are engaged in X-ray work:

A double-focus tube having failed to operate the day after an exhibition, and in my judgment such failure not being explained by an assumed and not-found deficiency in the power of the high-frequency coil used to operate it, investigation brought out a simple remedy. In the exhibition referred to, the tube was handled to some considerable extent *after* the demonstration. Perspiration from the hands had caused a dirty film to cover a large portion of the bulb, and, in consequence, the current leaked over in an invisible manner, for the high-frequency sprays are hardly noticeable. I wiped the tube with a damp cloth, drying it well afterward, placed it in position, and its usefulness returned. The advantage of a perfectly clean tube, used with high-frequency discharges, I have latterly and frequently demonstrated.

Very respectfully,
ELLIOTT WOODS.

Washington, D. C., May 4.

The Lake George, N. Y., Telephone Company has been incorporated, with a capital stock of $5,000.

Sparking of Brushes and Commutator Lubrication.

It has been persistently claimed by several builders of generators and motors that a properly designed machine will not spark at the brushes, provided it is working under normal conditions. Theoretically this is undoubtedly true, but in practice it has been found extremely difficult to operate electrical apparatus at all times without more or less sparking at the brushes, and consequent cutting or scoring of the commutator. The various causes of sparking have been repeatedly discussed and are now generally well understood, and builders, as well as operators of dynamo-electric machinery, seem to agree that some sort of a lubricant is necessary, not merely to overcome the friction between brush and commutator, but also to preserve that much-desired glaze or polish indicative of a properly-taken-care-of commutator. In the earlier days of electric lighting, the engineer or dynamo tender was usually instructed to occasionally "oil" the commutator, being cautioned at the same time that too much oil would do more harm than good. This was true, because no oil could be found with sufficient heat-resisting qualities to avoid burning of the insulation between segments, and the use of vaseline or similar substances not only aggravated the trouble, but generally caused gumming of the brushes, necessitating frequent cleaning and close attention generally. It is only during the past few years that the great value of graphite, in some form or another, as a commutator dressing has become known. The late Mr. McLennon, who will be remembered as one of the practical electricians of Chicago, experimented for years in finding a suitable compound, using graphite as the basis, and finally succeeded in producing a preparation known as Gale's commutator compound, which the company bearing his name claims to be the most effective on the market. It is claimed that it not only prevents all sparking, gumming of brushes and cutting of commutators, but even after a few applications gives the commutator that beautiful gloss and polish so much desired by the intelligent engineer.

ADVANCE INFORMATION

New Electric Railways.

LIVERPOOL, N. Y.—Citizens of this place, it is said, are promoting a plan to connect that town with Syracuse by a trolley line. It is proposed to construct an electric line through the town of Salina to connect with the Lakeside Electric Railway at Long Branch, if that line is built. Valentine Bond, George Shaver, George Richburg and Thomas Holleran, of Liverpool, are said to be among the leading promoters of the scheme.

LAWRENCE, MASS.—A movement is on foot for the building of an electric line from this place to Lowell by way of Andover, on the south side of the river, in conjunction with the Lowell, Lawrence & Haverhill company.

NIAGARA FALLS, SOUTH, ONT.—There are strong probabilities that a new electric road will be built in this village. The backers of the scheme are Henry C. Symmes, banker; R. Paine and others, of this village. It is their purpose to construct a line which will connect with the Niagara Falls Park & River Road in the Queen Victoria Niagara Falls Park, and run through several of the village streets up to Lundy's Lane battle ground and observatory. It is announced that as soon as the right-of-way franchise is secured the road will be built and in running order within 30 days.

PATERSON, N. J.—A movement is on foot to build an electric road from this place to Tuxedo Park, and eventually to extend it to Monroe. The road is to connect all places along the line of the Erie, and to fix the fare at a rate which will make it possible for suburban residents to keep in touch with the larger towns.

ST. LOUIS, MO.—An electric line will be established, beginning at Broadway and North Market street, and running over North Market street, Blair avenue, Benton street, Garrison, Cass, Prairie and Evans avenues, etc.

NIAGARA FALLS, N. Y.—The Lundy's Lane Electric Railway Company has been incorporated to build a line from Victoria Park to Drummondsville.

OLEAN, N. Y.—The Olean Electric Street Railway Company has increased its capital stock to $300,000. A six-mile extension to Portville is to be constructed.

DOYLESTOWN, PA.—The East Penn Traction Company has executed a contract with Messrs. Boody & Wheeler, of Philadelphia, for the construction of the electric railway between this place and Trenton, a distance of 25 miles.

WARREN, OHIO—Citizens of Hiram and Garrettsville are urging that the proposed electric railway from Chagrin Falls to Warren be constructed through those points.

CANTON, OHIO—Report has it that an electric railway may soon be built between this city and Alliance. It is said that Cleveland capitalists are interested in the matter.

Electric Light and Power.

NICETOWN, PA. — The Midvale Steel Company contemplate installing an electric lighting plant at their present plant.

WADENA, MINN.—The Electric Light Company is building an addition to power house. The addition will be used for a boiler room. A new boiler and dynamo has been purchased for the plant, which is now fully equipped with first-class machinery.

BERESFORD, S. D.—The Beresford Mill and Electric Light Plant has been sold to L. N. Crill and William A. Field, of Richland, S. D., and Louis Wagner, of Lennox, S. D., who will commence work immediately repairing the plant, and have it in running order at an early date.

OXFORD, MD.—An electric light plant will be established.

BANGOR, ME.—The Oxford Light Company, which is the new corporate name of the Norway Electric Light Company, has recently negotiated a mortgage on their plant at Norway for $80,000.

BEAVER, PA.—An electric light plant will be established.

BAR HARBOR, ME.—A new electric light station will be erected at a cost of $7,000.

COLUMBIA, TENN.—The Columbia Water and Light Company's new electric light plant is about ready for business.

PULASKI, VA.—The Pulaski Electric Company, recently organized, will apply for city franchise, and if same is granted will erect a plant.

TALLASSEE, ALA.—The Mutual Light and Power Company, of Montgomery, Ala., and the Tallassee Falls Manufacturing Company, have completed an agreement by which the 3,000 horse-power used at Tallassee Falls will be converted into electricity and wired to Montgomery.

WASHINGTON, D. C.—The Capital Railway Company, A. H. Walker, engineer, will erect power house at cost of $2,500.

JACKSON, MISS.—Frank Sharp, of Chicago, has been granted franchise for construction of gasworks, electric light plant, electric street railway, etc.

CARTHAGE, N. C.—W. H. McNeill is interested in establishment of water supply and electric lighting systems.

MILLEDGEVILLE, GA.—The Mayor may be addressed concerning establishment of an electric light plant.

MONTGOMERY, TENN.—The Mutual Light and Power Company has perfected arrangements with the Tallahassee Falls Manufacturing Company, located at Tallahassee Falls, to furnish it with electricity. Tallahassee Falls are 30 miles from Montgomery and the power will be conveyed to Montgomery over copper wires. Work will be commenced upon the lines of wires within a short time.

New Telephone and Telegraph Companies.

HUNTSVILLE, TENN. — John S. Van Winkle, of Danville, Ky., and James F. Baker, of this place, are erecting a telephone line from this place to Helenwood.

BRYAN, TEX.—A telephone line to Iola and Pankey, in Grimes County, has just been completed, and this place is now connected with the following towns not included in the long-distance service: Kurten, Willow Hole, Madisonville, Benchley, Iola and Pankey.

NEW CASTLE, IND.—The new telephone line connecting nearly every business house and residence in nearly every town in Rush and Henry counties has been completed. It extends from this city to Cadiz, Greensboro, Spiceland, Knightstown, Dunreith and on to Rushville. It connects with all local plants, wherever there are such, and combines the entire circuit under one system, but with separate management.

CASSOPOLIS, MICH.—An independent telephone line has been completed between this place and Dowagiac.

CHOTEAU, MONT.—The Choteau Telephone Company has already begun, and is now engaged in, putting up a line between this place and Dupuyer.

GLASGOW, KY.—Messrs. George Ellis and Dr. R. E. Garnett have established a telephone line between this place and Rocky Hill.

WATERLOO, IND.—The Central Union Telephone Company is stringing a new line from this place to South Bend.

FAIRFIELD, IA.—A franchise has been granted to W. R. Hind and others for the construction and maintaining a new system of telephones in this city. The monthly rate to be $1.50 for business houses and $1 for private houses.

SAGUACHE, COLO.—The Saguache-Moffat telephone line is now an assured fact. Enough stock has been subscribed to begin building, and bids will be called for soon to furnish poles and set them.

MCKINNEY, KY.—Telephone connection with Hustonville, Moreland, Mount Salem, Middleburg, Yosemite, Liberty, Combest and Dunnville from this place has been established. The lines are owned by the Hustonville & Green River Valley Telephone Company.

MCCOOL JUNCTION, NEB.—Among the new enterprises that will be located in this place this Spring is telephonic connection with outside towns and cities in the State. The Nebraska Telephone Company will build a line from here to Fairmont and York.

SENECA, N. Y.—The Seneca Telephone Company, to operate a telephone line along Cayuga Lake from Trumansburg, has been incorporated, with a capital of $4,450. The directors are John E. Purcell, Benjamin Franklin and F. C. Allen, of Ovid.

OWOSSO, MICH.—The City Council has granted the State Telephone Company a 30-year franchise, the rates to be $24 for business places and $18 for residence on five-year contracts.

Increase of Capital.

BRISTOL, N. H.—The Plymouth and Campton Telephone Company has increased the capital stock from $3,000 to $6,000. It will run a new line to Warren and extend its line, which now runs to North Woodstock, to J. E. Henry & Son's lumber mills, in Lincoln.

Business Troubles.

NEW YORK, N. Y.—Justice Beach has appointed J. Sidney Bell permanent receiver for the Ball Electric Light Company, in the suit brought by Royal E. Ball.

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Address "Construction",

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OPENING OF THE PROVIDENCE LINE.

The announcement of the reopening and the resumption of the Providence Line passenger service on May 10 is hailed with delight "by all lovers of comfortable travel". This Line is without exception the best route for all travelers desiring to visit Boston, Providence, Worcester and New England and the Maritime Provinces, combining the advantages of the longest water route and shortest rail ride, assuring passengers a full night's rest, with early arrival at destination, and the sail through Narragansett Bay and on the Providence River in the early morning or evening is a delightful feature, and will repay the early riser. The orchestras are superb, and the cuisine is equal to any first-class club or restaurant. The most distinctive feature, however, of this Line, and one so often spoken of by travelers, is the uniform courtesy shown by all its officers and employés to patrons, which is the more appreciated because so often denied the traveling public.

Steamers leave New Pier 36, North River, daily, except Sunday, at 5.30 P. M.

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There are also a number of furnished cottages with facilities for housekeeping.

The houses and grounds are supplied with absolutely pure water, piped from the celebrated "Boiling Spring", and are lighted with electricity. Deer Park is on the main line of the B. & O. Railroad, and has the advantage of its splendid Vestibuled Limited Express trains between the East and West. Season excursion tickets, good for return passage until October 31, will be placed on sale at greatly reduced rates at all principal ticket offices throughout the country.

The season at Deer Park commences June 21, 1897.

For full information as to rates, rooms, etc., address D. C. Jones, Manager, Camden Station, Baltimore, Md.

Kindred.... ...Interests

The Utica Electrical Manufacturing and Supply Company, of Utica, N. Y., has issued an attractive folder describing its extensive line of electrical supplies.

A fan motor in connection with the Edison-Lalande battery, for use where the usual incandescent current is not convenient, is made by the Edison Manufacturing Company, 110 East Twenty-third street, New York city.

The X-ray apparatus manufacturers are progressive and energetic. All of our subscribers interested should consult page V of this issue of the REVIEW for the latest manufacturing news relating to this branch of work.

Fred M. Locke, of Victor, N. Y., the well known manufacturer of high-potential insulators, has issued a new catalogue of his popular goods which should be in the hands of every one interested in the transmission of electrical current.

The H. W. Johns Manufacturing Company, 100 William street, New York city, has issued a new pocket-size catalogue of its electrical materials, comprising moulded mica and vulcabeston specialties, electric car heaters and electrotherms.

The General Agency Company, of 168 Broadway, New York city, dealers in railway material, are sending out illustrated circulars describing the Smith triple-expansion exhaust pipe. Managers of electric light and railway stations should be interested in this device.

T. H. Reeve & Company, ironmongers, 748 George street, Sydney, New South Wales, inform the ELECTRICAL REVIEW that they have recently started an electrical branch of their business. They desire to receive from American electrical manufacturers catalogues and trade literature, especially referring to telephones.

The New York offices of Schiff, Jordan & Company, of Vienna, have been vacated at 39 Cortlandt street, and a large warehouse, with adjoining offices, has been taken at 232 Greenwich street. Mr. Ralph Straschnow, this company's American manager, says that a larger stock of the carbons will be kept on hand, and the new warehouse facilities will enable quick shipments.

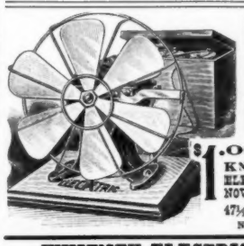
The Campbell & Zell Company, of Baltimore, among other large orders recently booked, have just received a contract from the Metropolitan Railroad Company, Washington, D. C., for 1,204 horse-power of Zell improved water-tube safety boilers, this making a fifth order from the above road, and aggregating nearly 3,000 horse-power of Zell boilers now in use at their several power houses in Washington.

The ninth edition of the "Red Book", just issued by Stanley & Patterson, 32 and 34 Frankfort street, New York, is a most complete catalogue of electric light equipments. The illustrations, of which there are five or six hundred, are of interest as showing the great progress in the multitudinous specialties which have been evolved from the first crude designs. The book is of interest to all those interested in this branch of the electrical industry, and will be sent on request.

It is the custom of the Electric Appliance Company, Chicago, to keep its customers posted on any changes in market prices, and to this end it is their custom to publish at frequent intervals a bulletin of prices on staple goods. Such a bulletin has recently been issued, giving present market prices on staple goods, and a number of the Electric Appliance Company's well known specialties. It contains valuable information to every purchaser of electrical supplies and will be sent to the trade on application.

The Metropolitan Electric Company, of Chicago, has been given the western agency for the electric heating apparatus made by Messrs. Whittingham & O'Brien. This line covers domestic laundry and tailors' irons of all kinds, electric heaters (radiators), etc. They report a growing demand for this class of goods, and especially for electric laundry irons. The extended use of electric lights in hotels and apartment buildings has done much to further the sale of these most convenient articles. The irons are arranged with a standard socket, so that all that is necessary is to unscrew the incandescent lamp and insert the socket, which is attached to the heater, and the apparatus is ready for use.

The American Engine Company, of Bound Brook, N. J., have just begun the shipment of their new direct-connected generating plants, in which the American-Ball engine is combined with their new line of six-pole generators. They are now installing a 75-kilowatt plant at 7 East Seventeenth street, New York, in the building of Deitsch Brothers, and a 35-kilowatt plant in the building of the *Evening Wisconsin*, of Milwaukee. In addition to this, they have orders from the Philadelphia *Inquirer* for a 100-kilowatt plant; the Buffalo *Evening News* a 35-kilowatt plant; the Phelp's Publishing Company, of Springfield, Mass., two 35-kilowatt plants; the New York *Tribune* a 75-kilowatt plant, and the World's Dispensary Medical Association, of Buffalo, a 25-kilowatt plant.



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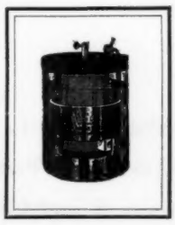
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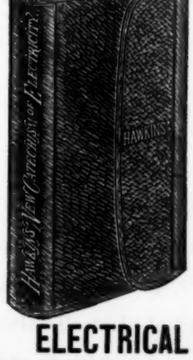

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THE ERIE TELEGRAPH AND TELEPHONE CO.,

Executive Office: LOWELL, MASS.

The "BOSTON TRANSCRIPT", of May 1st, says:

"The fourteenth annual report of the Erie Telegraph and Telephone Company, covering results of operations for the calendar year 1896, is an unusually interesting and valuable pamphlet, giving full details of the operations, plant, etc., of the three sub-companies, with maps of territory and cuts of buildings; in every way a highly lucid and creditable publication. The American Bell Telephone Company's interest in the management of the sub-companies is represented by Mr. John E.

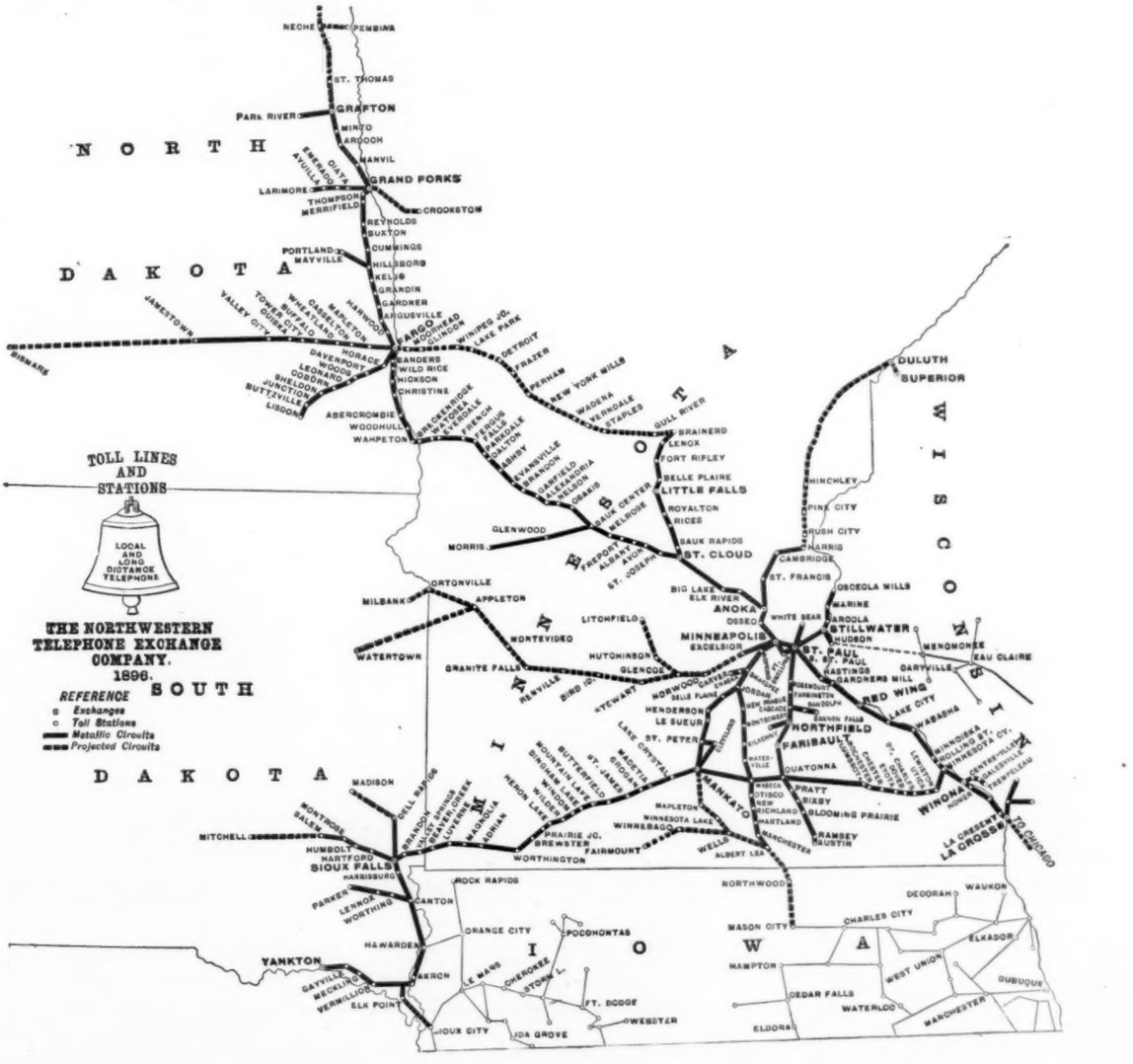
Hudson, Mr. Thomas Sherwin, of Boston, and Mr. David B. Parker, of Buffalo. Mr. Levi Sprague is president of the Erie and of the sub-companies; Mr. Charles J. Glidden, vice-president; Mr. George B. Perham, secretary; Mr. Charles A. Grant, treasurer; Mr. James P. McKinstry, general manager, with Messrs. Abner S. and Charles E. Adams, Glidden, J. W. C. Pickering, Asa C. Russell and Sprague, of Lowell, Mass.; H. D. W. Burt and H. F. Stevens, of New York; Wesley A. Gove and C. S. Tuckerman, of Boston, and Harvey A. Whiting, of Wilton, N. H., directors.

THE ERIE TELEGRAPH AND TELEPHONE CO.,

Executive Office: LOWELL, MASS.

(*Continued.*)

"The increase of subscribers in 1896 was 21,389, against 18,591 in 1895 and 16,174 in 1894; the net increase for 1896 being 2,798. The increase since 1883 is from 5,991 to 21,389. The total number of metallic circuit subscribers is 2,061; total exchanges, 65, against 63 in 1895 and 56 in 1894. Expenditure on the plant in 1896 was: New construction $828,317.65; maintenance, $199,823.78; real estate, $206,273.07; total, $1,234,414.50. Since 1883 a total of $4,839,459.96



has been spent on the plant, exclusive of cost of original properties and rights. In this period gross earnings have aggregated $10,745,911; expenses, $6,927,918; net income, $3,817,993. The Erie has paid fifty-three dividends, and No. 54 has just been declared, payable May 17. The company owns lands and buildings valued at $440,000 in eight cities, with others building or contemplated. A total of 43,032 miles of wire is in operation. The 1897 requirements are estimated at $500,000 for new construction; $200,000 for real estate; total, $700,000."

Electrical.... Patents.

[Specially reported for this journal by E. S. Duvall, solicitor of patents, Loan and Trust Building, Washington, D. C. Copies of any patent may be secured for 10 cents each.]

ISSUED APRIL 27, 1897.

581,366 Electric generator; C. C. Poole, Evanston, Ill.—Consists of a plurality of generator sections having reciprocating moving parts, and which act successively in the production of current, each of said generator sections embracing a plurality of conductors or generator elements acting to produce a plurality of electric inductions or impulses during the middle part only of the stroke of the movable part in each direction.

581,368 Support for electric railway conductors; E. D. Priest, Schenectady, N. Y.—A support for a tubular conductor, consisting of a clamp having separable members adapted to engage with the inner surface of the conductor, and means for separating the members of the clamp after they are placed in position.

581,406 Telephone receiver; W. J. Morton, New York, N. Y.—A telephone receiver having a soft-iron diaphragm located between two magnets, one of said magnets being a permanently magnetized disk and provided with perforations.

581,411 Printing telegraph; J. Burry, Long Island City, N. Y.

581,426 Primary battery; R. R. Moffatt, Brooklyn, N. Y.—A primary battery, comprising a metal frame having a plurality of openings therein, and a plurality of battery vessels in said openings, each vessel consisting of two cups with rims secured in the openings, one of which cups contains battery electrodes.

581,430 Semaphorical electric signal; R. S. Roberts, Philadelphia, Pa.

581,446 Electric call; H. C. West, New York, N. Y.

581,460 Electric fuse; W. E. Harrington, Philadelphia, Pa.—An electric fuse having a central primary section, terminal sections of greater cross-section, and masses of nonconducting material arranged to surround portions of each of said terminal sections without inclosing the central primary section.

581,465 Revolving electric headlight; J. Kirby, Dayton, Ohio.

581,528 Electrical alarm device; J. J. Barton, Ypsilanti, Mich.

581,544 Thermostatic fire alarm; O. A. Enholm, New York, N. Y.

581,548 Automatic combined alarm and stop mechanism for carding machines; J. F. Geb, Franklin, Mass.

581,557 Controller for electric cars; S. W. Huff, Baltimore, Md.—Consists of two relatively movable plane parts, a series of terminals to be connected, suitably spaced apart on one of said parts, and a corresponding series of bridging contacts carried by the other of said parts, each projecting into a space between two adjacent terminals and pressed against the opposed faces of the same.

581,561 Selective signal for telephone circuits; H. W. Mason, New Bedford, Mass.

581,658 Electric motor controller; W. H. Chapman, Portland, Me.

581,684 Electrical transmission of power; R. M. Hunter, Philadelphia, Pa.

DYER & DRISCOLL,
PATENT SOLICITORS,
36 WALL STREET, N. Y.,

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REFERENCES: "Electrical Review," New York; Paul Cromlein, Teller Lincoln National Bank, Washington, D. C.; Judge Geo. D. Parker, Berkley, Va.; Second National Bank, Washington, D. C.; E. K. Leech, U. S. Mint, Philadelphia, Pa.; W. F. Newell, Manager and Secretary Water Works, Olympia, Oregon.

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Solicitor of Patents, WASHINGTON, D. C.

Wanted—An Idea Who can think of some simple thing to patent? Protect your ideas; they may bring you wealth. Write JOHN WEDDERBURN & CO., Patent Attorneys, Washington, D. C., for their $1,800 prize offer and list of two hundred inventions wanted.

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EDWARD P. THOMPSON, M. E.,
Solicitor of Patents. Mem. Amer. So. Mech. Eng. and Mem. Amer. Inst. Electrical Eng. Author, "Inventing as a Science and an Art," and "Roentgen Rays and Phenomena of the Anode and Cathode." 14 years' experience.

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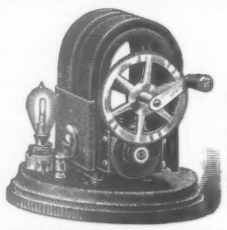

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